

AVIATION WEEK

A MCGRAW-HILL PUBLICATION

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50 CENTS

RUBBER "PLANTATION" IN MINNEAPOLIS

When we were developing a tank unit for one of our electronic fuel measurement systems, we needed rubber of especially high quality to use in spacing electrodes.

Upon investigation, we found no such material existed on the market.

So we called on the Honeywell Plastics Division to develop a synthetic rubber that would meet our requirements. They did, and for a time even produced it. That's why we dubbed the lab pictured here our "rubber plantation."

Today we obtain this rubber from an outside supplier—who uses the process and formula developed by the Honeywell Plastics Laboratory.

There have been many other occasions when the Aeronautical Division has received invaluable help from the diversified Honeywell organization—help with problems that seemingly were far removed from the aeronautical field.

We'll be asking for, and getting, this kind of help again and again in the years to come—because it's one of the best ways to make sure you keep on building *automatic controls* of the very highest quality for the aviation industry.

MINNEAPOLIS
Honeywell



Aeronautical Controls



RESEARCH *is the reason*

The new Engineering Research Laboratories at Hydro-Aire are considered the finest and most complete company-operated in their field. This division is equipped and manned to fabricate prototype parts from preliminary designs, evaluate their performance under conditions simulating actual operation and to qualify the units according to customer and military specifications—all without interference to general production.

Yes, Research is an important reason why every fighter, every bomber, every transport is Hydro-Aire equipped.

HYDRO-AIRE Inc.
BURBANK, CALIFORNIA
Subsidiary of Cessco Co.

MANUFACTURERS OF PNEUMATIC, HYDRAULIC, PNEUMATIC AND ELECTRO-MECHANICAL AIRCRAFT ACCESSORY EQUIPMENT

B.F. Goodrich



New B. F. Goodrich cell weighs 38% less, carries more fuel

NO AIRMAN is one model of the Thunderjet in production that designers start again on their perpetual job: shave every possible ounce of weight—make room for more armament. Here every possible cubic inch inside fat fuel—make way for longer flight range.

Republic engineers figured they could carry more fuel if they could save all the space in the wings—incubating odd-shaped tanks and covers like this would add weight, and it looked as though the tricky shapes couldn't be built anyway.

They brought this dual problem to B. F. Goodrich. Here, engineers tackled the impossible shape wars. A thinner wall was developed that would still stand as well under pressure. A way was found for building shapes that would fit into the odd corners, every spare fuel. And finally, a lighter lining was worked out that saved still more weight.

It all added up to more gallons of fuel and 38% less weight than cells in the early Thunderjets. The new B. F. Goodrich cells have been proved on the famous F84G, will soon be saving duty on the new F94F and RF-4H.

The development of the Hydro weight fuel cells is another example of BFG leadership in rubber research and engineering on the problems of modern design. B. F. Goodrich products for aviation include tires, wheels and landing, breast rubber, Deform-Airons, Plastiluck adhesives, Pressure-Sealing Zippers, indelible seals, Rivnuts, accessories. The B. F. Goodrich Company, Akron Division, Akron, Ohio.

B.F. Goodrich
FIRST IN RUBBER



MYSTERE 4 BETS 617 MYTH—During a recent demonstration for Allied officials, this new Dassault Mystere 4 fighter hit 617 mph. It has a Hispano-Suiza 15 with afterburner. U.S. has a provisioned off-shore procurement order for 150 Mystere 4s.

New Aircraft In the News

NEW KANSAS FLOWN—A pair of the latest model HTK-10 helicopters (right) in flight at the Kansas plant, Windsor Locks, Conn., showing their new tail assemblies. These craft have shorter tailbooms than previous HTKs and increased lift area. The new dual-shaft control has each have 13 sq ft. area, and the rotor disc has been increased 2.5 sq ft. to 32.5 sq ft. The blades have been aerodynamically modified.



PRODUCTION F-50F SHOWN—Below are first photos of a production wingman Republic F-50F displayed at a recent "open house" at Farmingdale, L. I., N. Y. Particularly noteworthy is the new outboard engine design. Passage doors are behind wings.



WHO'S WHERE

In the Front Office

William W. Wood, chief engineer for Lark America, Inc., Binghamton, N. Y., has been named vice president succeeding by the firm Wood joined Lark in 1941 as a field engineer.

John F. Davidson has been designated a vice president of California Eastern Airways, Inc. He joined CEA last January and at the time was director of operations for Air Transport Corp.

R. E. Martin has been named director of technical assistance of the International Civil Aviation Assn. His previous post was as technical relations officer for KCAP.

Changes

Lois G. Ruckel has been appointed works manager of American Car & Foundry Co. Charles M. plant where he is responsible for 44 design sections.

Robert A. Kuehn has been promoted to superintendent of Hamilton Standard division experimental shop, Windsor Locks, Conn. Other promotions: **Lawrence P. Hoffman**, assistant superintendent, engine, metal manufacturing, and **George W. Rice**, metals and methods.

George Pittman, Jr. has been appointed director of aircraft sales for Chandler-Peapack Co., Camden, N. J.

James M. Whitte has been named manager of the newly formed industrial relations department of Westinghouse Electric Corp.'s Aviation Gas Turbine division, Philadelphia, Pa.

Anthony J. Kieber has been appointed manager, Manufacturing division, Pacific Aerospace Corp., Portland, Calif.

G. C. Spiller there has been named vice president of the firm. **Raymond E. Armstrong** has been named to the director of engineering. **Al Greenwood** has returned to the company to fill the executive post of chief of sections and will also be chief of manufacturing.

Thomas E. Monte has been named general sales manager for G. M. Corbin Co., Pasadena, Calif.

Lawrence J. White has been designated Northeast Airlines' director of transportation and city ticket office, succeeding **Robert F. Buckley**, retired.

Franklin D. Wilcox, formerly managing editor of Flying magazine, has joined Lark America, Inc. Y. joining technical staff. **William Koopfer**, Eric Lee and **William Conklin**, whose names did not appear on *Aircraft* 11/1/57's masthead, this week, are engaged in a special project of the Madison Hill Publishing Co., which will be as announced shortly.

Honors and Elections

Pete Gillies, San Diego, has been elected chairman of the board of the Navy's Navy sponsored all-weather aircraft (NACA) project. The air was based on the Navy's Navy sponsored all-weather aircraft (NACA) project. The air was based on the Navy's Navy sponsored all-weather aircraft (NACA) project.

INDUSTRY OBSERVER

► Don't be surprised if *Haward Hughes* sells the Hughes Aircraft Co. at Cedar City soon and withdraws from the aviation and electronics picture. Factoring field. Air Force is now quietly arranging prospective purchases to determine if there have been technical, financial and management questions to may out Hughes' heavy commitments to USAF on satellite sales, guided missiles and jet helicopters. Internal management troubles is one reason for the impending sale.

► Watch for the Glenn L. Martin Co. to get back into the USAF picture with a design for a supersonic jet bomber aimed at low level attack work.

► Concern shortly will light out its F2Y, expensive water-based fighter, with hydrofoils—retractable water skis developed for aircraft water landings as a result of joint research by NACA, Navy, Coast, Edo and All-American Services.

► Navy's Bureau of Aeronautics doesn't anticipate the current bottleneck in production on the Wright J65 (Supplement) turbojet will affect its current order for the engine. Order was for relatively small quantities for a new fighter—the North American F-8. Present schedule schedules indicate the engine for nearly be completed for at least another year. If Wright makes good on the initial Navy delivery schedule the J65 may be used in additional Navy fighter types.

► USAF and Navy finally have resolved their arguments over the size of future turbojet development with a decision to put engines in the new development turbojet in the 15,000 hp size. Largest current development projects are the P&W F75, aimed at about 3,000 hp, and the Wright TR-8, a turbojet variation of the basic Supersonic design.

► Aero 195 delta bomber has been named the Vulcan. It is powered by four advanced versions of the Rolls-Royce Avon and is capable of very high subsonic speeds.

► Aerotec Ltd., one of the largest British works, has applied to the British Air Transport Advisory Council for a license to operate trans-Atlantic freight service between England and Montreal-New York. Initial service would use York and Tudor aircraft and begin in June 1957. Aerotec expects to land about a thousand tons of freight annually in such direction with a semi-regular service to both America terminals.

► Naval Air Materiel Center at Philadelphia has developed a device for accurately and easily measuring the striking speed of aircraft. An electronic tape is transmitted from a radar antenna in the aircraft and recorded by a Polarograph system on the ground. Results are available as soon as the aircraft completes its landing.

► Pratt & Whitney Aircraft's latest version of the J45 centrifugal-flow turbojet with afterburner is now delivering more than 10,000 lb thrust. It will be used in the Lockheed F-94C Starline as another turbojet. J45's original thrust was 8,250 lb without afterburner.

► British are extremely anxious to expand their production plans for the Gloster Javelin, delta-winged all-weather fighter. American technical advisers to the MSA off-shore procurement program feel the Javelin meets NATO night fighter requirements better than any now scheduled for procurement. The near blocking of orders of the Javelin in the current off-shore procurement program is the 1957 delivery deadline set for NATO requirements.

► U. S. has tentatively agreed to buy 340 Supermarine Swift jet fighters under the off-shore procurement program, contract on order by late 1957. As part of the contract, the British were required to buy three Swift commitments by 1960 planes, which has been done. The U. S. contract eventually may cover only 200 of the fighters, considering delivery deadline and fuel limitations. Observers are seeing RAF pilots fly by at the Swifts ordered under NATO specs.

Style Bridges, who contends that, but for his Bridges will choose to lead the Subcommittee handling House Defense funds voted. This year Ferguson pushed for substantial cuts in Air Force procurement and research appropriations, but he didn't go along with some of the cutting and slashing proposed by Moore. Ferguson indicated the subcommittee which conducted the Hughes-Brester investigation in 1947, and is an instance of a developed ordinance that later and Stuart Myers the former USAF officer to charge at Wright-Patterson AFB during the war, in person.

• **Rep. John T. Tamm**, known as Congress' leading peace officer, is likely to head the Subcommittee on Armed Services, as well as the full House Appropriations Committee. This year, when the subcommittee was split in three to spend up action on the defense budget, Tamm's strong influence on the group handling USAF funds.

• **Sen. Charles McNair**, in line for his re-election of Senate Interstate and Foreign Commerce Committee, has been sympathetic to the civilians in their fight with the military industry. Reeling Republicans on the Small Business Committee. Tamm may not take on the chairmanship of this group which has spearheaded the movement on Capitol Hill. Tamm has not actively participated in aviation. The one exception appears to be a new inquiry for international air service, advocated by FAA.

• **Rep. Charles W. Whelan**, due to take over the chairmanship of House later in the year, has generally opposed radical positions. This year he led the major group which objected to annual military appropriations legislation, in the committee on being too lenient to the scheduled aircraft. He wanted the industry field opened to the airplane manufacturer.

• **Three Senate Democrats**—There are two aviation lawmakers.

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WINS WRIGHT AWARD

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In 1936, Doolittle moved to a job in the Air Force in 1941 to 1947. He is now a lieutenant colonel in the Air Force National Guard, serving as Chief of Staff for Air.

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New Faces

In addition to Lodge, Eisenhower political appointees may be the new faces of the Pentagon, among the defense program, include:

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AF Criticized for B-36 Tornado Loss

A forthcoming Senate Subcommittee report is expected to criticize the Air Force severely for concentrating most of the country's B-36 strategic air force at the Air Force AFB, Ft. Worth which was hit by a B-36 on Tuesday last Labor Day. One B-36 was destroyed and 106 were damaged or destroyed in the crash. The report of the subcommittee headed by Sen. Lyndon B. Johnson has been drawn, but a final decision has not yet been made on releasing it to the public.

Meanwhile, in a letter to Sen. Alexander Wiley, the chief of the Senate Subcommittee on Armed Services, Maj. Gen. William McKee explained that the tornado was a "calculated risk" and that the Air Force was "not to be blamed." The Air Force was "not to be blamed" for the crash, McKee said, "because it was a calculated risk." McKee said, "we must continue to hide the colored glass of putting 'war eggs' in our basket."

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Lockheed Strike Settled

The Lockheed war strike, involving some 27,000 employees, has been settled but terms will not be announced until later, according to the Federal Mediation and Conciliation Service.

Some Policy Revisions Certain

GOP-controlled AGC to study foreign airline grants, development subsidies, zoning, other problems.

U S aviation policy is sure to change in some ways when Republican take over the end-of-the-war Air Charge Committee. AGC policy on at least one point is sure to change. The committee will study foreign airline grants, development subsidies, zoning, other problems.

AGC membership includes one top level representative each from Air Force, Army, Civil Aeronautics Board, Commerce (formerly CAB), Navy, Post Office, State Department, Treasury, Federal Reserve and National Security Resources Board. All are political appointees.

Major policies to be reviewed:

- **Grants to foreign airlines.** The Republican Administration has expected to continue future applications by foreign airlines for grants to develop air routes.

The Air Force and Navy have been in the line for the past year, the AGC has approved Airport Improvement Grants of \$15 million to foreign airlines, or governments for airbase use.

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aviation in importance at mid-airports in the country.

• **Other Problems for AGC.** There are also some new policy matters coming up for AGC decisions.

• **Federal zoning.** One that will require AGC action is a bill for a proposed action in a law to clarify federal zoning power in the air.

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NIGHT STRIKE ENDED: a B-29 Supersonic bomber starts to lose, then



DAYLIGHT BOMBING is taken up by F-84s in aircraft "round the clock aerial pounding."

Combat Report From Korea

AF Switches Tactics in Korea

Saturation raids by B-29s, B-26s have destroyed Red powerplants, stopped railroads and industry, G-2 says.

By R. P. (Pepper) Martin
(McGraw-Hill World News)

Tokyo—On June 24, 1952, the end of the second anniversary of the Korean war, a flight of 25 B-29s made a saturation raid on Communist gun crystal furnaces, troop concentrations and supplies in an escape route of the Yalu River. In a sense it was the Air Force's farewell gesture to a peculiar pattern of close support and assaults in "Operation Strangle," a confused type of air war dictated by the United Nations. Communist's concern with keeping the peace talks on a fairly even keel.

Within a few hours the Air Force was engaged in a business episode that it knows and understands: a carefully planned campaign to destroy the Communist war-making facilities, supply lines, storage dumps and of non-essential civilian works in the wild mountain areas between the Yalu River and the front.

In the last week of October the Air

Force had dropped 42,000 tons of bombs, 15,900 rockets and 200,000 gallons of napalm on selected targets. B-29s flew 7,100 sorties. B-26s most of them during night intruder raids, flew

Combat Reports

Two front-line stories in the zone by AMERICAN WIRE's Far East correspondent R. P. Martin, are significant to the war's industry and particularly timely in light of the proposed visit of President-elect Eisenhower to Korea. The areas pinpointed show, containing industrial plants and the secret lab, detain transition of USAF in Korea from confused and limited objectives to saturation bombing. Starting on p. 62 is Martin's description of how the C-124 is meeting its last term in Korea.

5,000, and the remainder were by lighter bombers. Although the total does not include American F-86s and close support remains, the assault north of the line represented 80% of the total air effort during the four-month period.

• The Results—in capsule form here are the results of the effort based on intercepts tap secret intelligence sources from undercover agents and refugees, bomb damage assessment photo graphs, and other secret reports made available to American Wires by General Mark Clark's UNC headquarters.

• 100% of all hydroelectric generating plants in North Korea have been destroyed.

• Industry in general is virtually at a standstill.

• North Korea's excellent subway network is operating at less than 75% of its pre-war capacity.

• A decline in civilian morale and a near-depleted shortage of food is placing a heavy strain on the Communist economic and military establishment.

The north have not actually withdrawn the country's capacities to provide logistical support for their army permit combat conditions but they have prevented the Reds from accumulating reserves needed for a national ground offensive.

• American Intelligence: "The air effort is a logical development in the Korean war. The battlefield was static and the Communists were using the hill during the peace talks to build a forbidding industrial establishment north of the Yalu River. Some military architects believe that annexed air power, at a negligible cost of loss, might also make the Reds more amenable at the coming peace talks.

Air Force was bitterly aware of the growing confusion among them in failure to shut off completely the flow of men and supplies to the front. The theory that air power can be decisive in war is being questioned. At the same time, the First Air Force headquarters realized that effects of the campaign would be limited by the rapid loss in strategic strikes against the enemy's position of supply and reinforcements. One general commented: "It's difficult to get an adequate status on the enemy's resources, by hitting the products only after they move in the supply or support line."

Despite this handicap, the Air Force welcomed the opportunity to unleash its striking power. Now, General Clark's G-2 reveals what air power can do despite the usual limitations.

• **Hit at Chosen**—Prior to the war North Korea had a fairly efficient industrial plant situated near the Japanese iron and steel plant that as its task was had produced 150,000 metric tons of steel and shipped 90,000 metric tons of finished steel a chemical index.



SUPPLY DUMPS near Yalu undergo saturation treatment by B-26s

Bombers Raze North Korea



CHEMICAL PLANT on southeast bank of Yalu, destroyed by B-26s

ELECTRIC POWERPLANT stricken by U.S. coverland planes



RAILROAD BRIDGE pressure bowled by B-26s



ROLLING STOCK trampled by fighter-bombers

GOLD MINE was 90% destroyed by Superforts



ties of Hwanggan that produced 300,000 tons of fertilizer, 210,000 tons of steel, 9,500 tons of sugar, soda and 700,000 tons of cobalt; a petroleum refinery capable of producing annually 125,000 tons of refined products.

UN air attacks in the last three months of the war destroyed the largest proportion of this industrial plant. A top-level decision, however, placed the huge North Korean hydroelectric power complexes (not subjected to UN air assault). These complexes, including Taishan plant, had a total capacity of 2.5 million kilowatts, far in excess of domestic requirements. Surplus power was normally diverted to Manchuria.

► **Two Problems**—The UN's intervention in the war drastically changed the strategic picture. About one-third, or 100,000 tons of the sulfur output alone went to Manchuria, providing power for the copper and molybdenum of the Incheon and MAC-15 units at Aikang, Taishan and Tachungang airfields, and for Communist war plants in Mukden, Durn and Port Arthur.

During the truce lull, the Chinese heavily developed small-scale iron and steel, fertilizer and power facilities throughout North Korea. This industrial development was prompted by the search for a solution to two problems:

► The Chinese were brought to rely on supplies from Manchuria, but North Korea's troops in the combat zone needed small arms and grenades, mortar shells and small arms ammunition, machine guns, rifles, bazookas, batteries and other stores.

► The second problem was the supply of tanks, guns, vehicles, locomotives and railway rolling stock, in close proximity to the battlefield.

The Reds solved both problems by building small plants throughout North Korea. These were located along or close to the transportation lines from the hydroelectric plants. The majority of these were fed into the Soviet transmanchurian line that often began manufacturing along intermediate lines from the Chinkiang and Fushen outcrops when the main damage line suffered during the bridge of late 1950 had been repaired.

► **Rail Power**—Most of North Korea's present industrial effort is small, centralized and widely dispersed. The only method of attacking it was through direct assault on the power complexes.

Once the assault began, the Reds claimed that the powerplants were not suitable installations and that the UN was attacking civilian targets. In early May, the UN's position shifted that only a certain quantity of power was devoted to rice-pounding mills and the operation of irrigation facilities. The remainder fed directly into the war effort.

The bombing attacks since June 24

destroyed about half of all hydroelectric generating plants and damaged an additional 25% to 45%. Intelligence reports indicate that all power output in North Korea was halted after this initial attack. Many of the manufacturing and repair installations were closed down completely. Facing communications were cut (not only) small generator units were brought in from Manchuria. Red's strikes went off the air, and gasoline, kerosene and cobalt were shipped in from Manchuria to provide fuel to underground installations.

► **Interception Is Slow-Down** and Chinese technicians were dispatched to repair plants. In early August, new shore power-producing facilities were brought into North Korea, and from southern lines were moved to bring in power from southern Manchuria. Intelligence reports state that these have been met but not a full understanding of these facilities.

The destruction of the South coast (despite increased demands on the industrial and military potential of the country) together with the Communist action in Korea. Auxiliary power output, vehicles, locomotives, rolling stock, small arms ammunition, tanks and guns which transportation can no longer be produced or repaired in North Korea must be supplied from the outside, be Russia or be China.

The UN air attacks against the North Korean rail system have been counterproductive. The first work of the war, and it is difficult to measure the effects of the recent assault. However, even yard of importance has been destroyed or severely damaged. The destruction to repair and maintain facilities has been so great that at the present time the only repair work performed on transport equipment is on towed, specially loaded cars and damaged engines or trucks.

► **Rail Traffic Hit Hard**—The most sig-

nificant destruction has been concentrated on the network that would normally feed directly into the front lines. G-2 points out that rail traffic south of the 38th parallel, roughly the Pyongyang-Wonsan line, has been far more completely shattered than anticipated. From the military viewpoint, the Pyongyang-Kaesong line is the most important artery in North Korea. Before the war, this line had a capacity of 10,000 tons every 24 hours. Now G-2 reports that it carries an average of about 100 tons a day, and then only through shunting and truck transfer around the blown-up sections of the line.

The second most important line, that running from Pyongyang to Wonsan, would be an available supply line feeding into every part of the combat front. Before the war, it had a capacity of 9,000 tons every 24 hours. Today, nothing moves on that line.

The Communists now rely primarily on trucks, pack animals and human pack transport in the area south of 50th mile of the front line. The effect is somewhat better further north. New or repaired equipment is brought in from Manchuria for use on these lines (mostly, being shipped by the Reds). This has placed a considerable burden on the Communist supply system because rolling stock and locomotives are scarce in direct supply throughout the Communist front.

► **Red Offensive Hard-G-2** heavily admits that about 50,000 tons can be moved each day into Korea from Manchuria. But the difficulty of transporting such an enormous amount with such a poor network. The G-2 report adds: "As yet, the North Korean line has not been relieved of the reduction of the enemy's capability to transport supplies to the forward zone, but there certainly have existed his capability of mounting a sustained all-out ground offensive."

Destruction of the powerplants had an immediate effect on North Korea's economy. Further, directly affecting the lack of fuel for the Red's heavy industry (in March in 1950 of an individual's production is taken away in taxes, dues and "voluntary donations") rural (the irrigation system) launched that the whole power was cut off for the pumps. The North Korean army, following a pattern (especially outlined by the Chinese Communists during the first war), organized numerous guerrilla formations from guerrillas and physically well-trained personnel. They killed the land and also acted in local home guard units.

Intelligence reports indicate, conclusively, that the military conditions south of the war front are not as good as the country. There is no net no widespread starvation but the minimum level is dropping below the danger limit, G-2 estimates that the full battle probably affect very heavy, immediate destruction of the food situation. But unless consumption is not reported to be as poor.

► **Japanes Lost-Communist** made in various and under as bombardment, always a considerable number. But G-2 reports indicate that the morale of the North Korean population is at its lowest point since the beginning of the war. From the front, the UN air attacks are being subjected to direct attack, are forcing the air forces. They are concentrated to supply bridges and railroads, and to construct fortifications. A former further his own food and clothing during the period of work conditions.

The Air Force killed 75 areas in North Korea in targets, and warned civilians to leave these areas. On one area, a warning was broadcast from an airplane or over Soviet radio only 12 minutes before the target was bombed. Within the warnings of the raids themselves resulted in a decided civilian loss (estimated between 100 and 200) from Pyongyang, the central, but apparently south of its previous population.

The North Korean government tried to end the raids by ignoring a frantic propaganda campaign stating that power would quickly be restored and jobs again would be available.

Chinese morale is probably not of top concern to Red leaders. In World War II, Germany continued operations and it was occupied despite several years of bombing in Berlin. The Japanese were prepared to fight for their homeland even though most of their industrial centers were an ruins.

► **No Peace-Communist** purpose is not likely to force the Communist leaders to face the fact that more than 100,000 lives in the North, G-2 states that the Reds will then push their north side, possibly can keep the situation

well under control and "actively means" as connected by the air" are rapid enough to prevent any interference in the war effort.

The greatest single weakness in the summer's effort is that it has not affected morale of the Chinese and North Korean troops. A G-2 evaluation states that the morale of the enemy troops is reflected by their combat effectiveness is considered good, and morale of the Red core groups is excellent.

The average soldier in the front lines receives a daily ration of approximately 25 pounds of food, supplemented with sporadic rations of meat and fish. This ration is more diversified than Red troops received during 1950.

The lighter standard according to G-2, "has been at the expense of the Chinese population. It is expected that should the food supply in the future, either for the military or civilians, reach the point where military operations are interrupted, these supplies would be immediately suggested by imperfection of food from China and the Soviet Union."

New Flight Rules
For Newark Airport

In preparation for the scheduled reopening of Newark Airport (N J) to full-scale airline operations Nov. 15, a set of flight rules has been developed by the National Air Transport Council's new Committee to increase the safety factor for accidents of nearby populated areas.

These new procedures are also aimed at lowering aircraft noise levels, also a major cause of complaint from people living near the field.

Respecting of the field, closed since Feb. 11 following several crashes into

nearby Elizabeth, has hinged on completion of a new 7,000-ft instrument runway by Port of New York Authority costing \$6.4 million.

Now is the way the runway performance criteria is laid down:

- First choice for landings is to be over the Kearney Meadows area Runway 22 or over Newark Bay onto Runway 28.
- Next, over Arthur Kill onto Runway 3 and Elizabethport. Final choice, over Weequahic Park onto Runway 28.
- First priority for takeoffs will be over Newark Bay on Runway 19 or over the Kearney Meadows on Runway 4. Next choice, over Arthur Kill and Elizabethport on Runway 22, lastly, over Weequahic Park using Runway 23.

The restrictions will be used when weather is below minimum ceiling 1,200 ft and cross winds on the runway are not more than 15 mph. The committee has estimated that such conditions will prevail annually more than 95% of the time.

Grounding of planes will be done in areas distant from populated sections and training flights will be restricted to the minimum required by CMA to maintain pilots with the required skills, are being held to maintain 1,200 ft altitude until so new to the field as possible and to get the 1,200 ft, as soon as they can after takeoff.

Rails in Australia
(McGraw-Hill World News)

Sidney-Rolls Royce plans to set up engineering offices in either Sydney or Melbourne, to provide engineering link up to British airlines which are expected to begin operations in Australia soon. A number of key men and one suitable component will be obtained from Britain.



NEW PAPER FLIES ON HALF POWER

Paper Train Steam light transport is seen during a single-day run at 6,000 ft, an standard engine load. Of interest is change to a single 16-in. roller, the plane engine applied with new tools. The first place Piper is powered by 210 hp. Locomotive

engine. First deliveries are scheduled as late 1955. The company is producing materials now for an initial production run of 100 plants. Company reports that of the new engine will be made using Bortelli technology.



MARTIN 4-04 JOINS COAST GUARD

Don't one of the two Martin 4-04 is ordered by the U. S. Coast Guard in its new military class of BuAircraft, 404, joins at Adversity. Designated 404E, the Coast Guard plane is similar to the commercial version being

CAB Setup to Remain Intact

Principal change under GOP will be filling vacancy on Board; staff members are protected by Civil Service.

By Lee Moore

The Civil Aeronautics Board organization—like those of the Interstate Commerce Commission, Federal Communications Commission and other quasi-judicial regulatory commissions—will not change, radically when President-elect Bush takes over.

The 56-year CAB staff reporting to the Board and its Chairman is fully protected by Civil Service.

The only new personnel change at CAB is the appointment by Bush, lower of one man to fill the present vacancy on the Board—left by resignation of former Chairman Donald Nyberg. The only other new change is a modification of CAB procedures to assure more membership control over the Chairman's administration of the staff. That no matter who is appointed as fifth member and who is designated Chairman, the combined tenure of the four present Board members guarantees CAB will go along pretty much as shown on policy and personnel.

That was the exact intent of Congress in passing the Civil Aeronautics Act of 1938. The act provides that a minimum of three of the five members shall be of one political party. This is designed to place the Board under partisan politics. The act provides no limit to membership appointments—to put these individuals in for about "influence" is possible.

► **CAB Members to Hire—Compensation and Work Hours** and the government attorneys involved in no early post-election suggestion that all CAB members should "make amiable their resignations and thus give the new Bush Executive a clean slate" makes up a new Board and that "it would make a lot of sense to leave the class up to the White House."

These observers pointed to the historical fact of all regulatory commission memberships set up by Congress in the past half century. If CAB members could be expected to leave because a new President comes in, as is also true "CCC and other quasi-judicial commissions."

The last section of the Civil Aeronautics Act Sec. 101(a), in clear as that point it states that the authority, now the Board, "shall be composed of five members who shall be appointed by the President in and with the consent of the Senate..." The successors of the (first members) shall be appointed for terms of six years... The members... may be reappointed by the President

for inefficiency, neglect of duty, or infraction of office (malfeasance). No more than three of the members shall be appointed from the same political party."

CAB design is the last word except for the courts on domestic aviation regulation. In exceptional cases, when the President has superior power under the Constitution he can and often does overrule CAB.

So the five-member CAB is set up by act of Congress as a continuing body, with only one member per year coming up for reappointment, except that every sixth year no member's tenure shall expire. But every year one member is designated or re-designated as Chairman.

Airline from appointment of a fifth member to fill the existing vacancy, there is also a chance for another change. Republican member Chairman's term expires Dec. 31. But observers believe he is around of re-appointment and perhaps the chairmanship, unless he prefers some other Republican appointment which might be available to him. Jimmy told American Wants to let him CAB job.

Democrat members Joseph Adams and Jack Lee and Republican member Oswald Ryan also fill their jobs and have served the term of reappointing.

► **CAB Staff Unchanged—The entire staff of the Board is on Civil Service status. Board officials say there is no technical basis for a large post-election report that CAB staff activities jobs are "open at the discretion of the White House."**

No CAB staff appointments has ever been denied through the White House, according to Board Secretary Maude G. Mathews and Executive Director James Vossler. Now a three or statute or executive order providing for appointment of CAB staff by law but the Board Chairman and members.

The staff executives are "Schedule A appointments" under Civil Service. This means they can be moved to an other Civil Service job but may not be fired except for cause. This "Schedule A" involves in filling and changing its top spots is provided to enable the Board to select executives who are sympathetic with the overall policies of the Board members.

Even the three top Civil Service "super grade" jobs at CAB were offered in preference of the Civil Service Commission, not the President. Once the job and salary are presented by the CSC, the Board shall appoint the man to fill the job without reference to any

outside government agency. Three out of the five members must approve the appointment, and to prevent all five members approve a man before he is appointed for a top CAB staff job. The "super grade" appointments subject to CAB review (not White House) decision to change per General Counsel Rancy T. Nunnally, Jr., and Bureau of Air Operations Director Gordon Ross (\$12,000-\$12,500 a year) and Executive Director James Vossler (\$12,000-\$13,500 a year).

The expected CAB modification of the Chairman's staff administration responsibilities also will have little or no effect on the staff, except to make sure that their hiring and firing is directly at industry up to a five-year Board rather than the possible whims of one man the Chairman. Otherwise CAB goes on as before. Policy changes will vary only at the membership majority consensus merge with new member appointments over the term for only one Presidential appointments in accordance with the Civil Aeronautics Act. The staff and the staff executives are protected by Civil Service and by the Administrative Procedures Act of 1946.

► **Efforts to Change Policy—While CAB members and staff are protected for the foreseeable future in the Civil Aeronautics Act, there will be strong efforts by various interests to seek the switch to GOP to advantage.**

The last surface are about to engage in a fight for profits considerably higher than the 7% to 8% historically paid by the CAB in "fair and reasonable" under the Civil Aeronautics Act. They argue that they need big profits in the present prospects to make sure that can pay expenses set transport later. If the Republicans are more likely to succeed than the Democrats, so their platform states, the industry wants to get to it on it. However, the influence must be reduced under the letter of the Civil Aeronautics Act. CAB will be in a decision, except on international matters where the White House may disagree.

The coalition surface looked for further help from the Speakerless Senate. Republican Committee under a Democratic Administration. Now, without an obvious threat in the Republican camp that will then their first extreme position fighting against federal bureaucratic restrictions imposed by CAB to protect the "certified airlines" mostly owned by the Democratic regime of the 1930s.

Conservative observers forecast it will take at least a year and perhaps more before industry try to seek to change the Civil Aeronautics Act to their advantage. Their best bet appears to be influencing the President's appointment of CAB members to "move on the five-year Board."

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technical bulletin

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fulfills inverse
requirement

• EEMCO has designed and built a new motor with a minimum operating speed of 5,500 rpm and a maximum of 15,000 rpm. Ordinarily such a motor would carry its heaviest load at low speed, a light load at high speed. This motor speed a light load at high speed and at low speed to an opposite requirement: runs at low speed under a small load (25 watts at 5,500 rpm) and at high speed under high load (200 watts at 15,000 rpm). Weighted five pounds and operating at 24V, this motor performs under continuous duty with a rate of cooling air.

• The problem was to maintain shaft speed under some variable speed without the undue stability loss which normally accompanies this situation. EEMCO's unusual ability to design and build for highly specialized requirements has highly advanced requirements and made a highly restrained, virtually application practical which before had not been possible.

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We have prepared a descriptive booklet on the Collins Navigation Computer and will be glad to mail you a copy on request. Also available are 15-minute demonstration films of the Collins Flight System.

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AERONAUTICAL ENGINEERING

New Frontiers of Aeronautic Engineering

- Here are the guideposts to tomorrow's advances.
- By-pass engine, wing schemes are rich fields.

By David A. Andersen

The frontiers of aircraft engineering have never been static and aren't now. New developments, new techniques, new approaches have permeated, expanded and invigorated large areas of aeronautical knowledge.

Not with last generation jets such as we build comes the certain understanding that there are larger fields ahead, and another full beyond that full. Today's aircraft engineers are looking ahead to their explorations of tomorrow. Here are some of their guideposts—new developments in aircraft powerplants, aerodynamics and structures.

By-Pass Engines

The recent disclosure of the Rolls-Royce Conway (J40-2)—believed to be the world's first by-pass engine—has added just one more to the list of new powerplant technology.

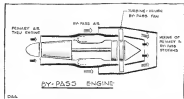
Rolls says that the engine now designed generally for long-range transport and bombers. Like the old design use of the by-pass powerplant, which is to improve fuel economy. It is not a thrust booster.

Where there is the prime consideration, there are three ways to reduce the specific fuel consumption of the jet turbine.

- Drive a propeller, as the now-familiar turbo-propeller does.
- Use a light gas turbine (Aviation Week Feb. 26, p. 11).
- By-pass some of the intake air.

The by-pass engine has some similarities between the turbojet and turbo-prop engine, and shows some characteristics of both types. This engine has improved core efficiencies compared to the turbo jet, it produces somewhat higher thrusts at low and medium speeds than the turbojet. But its thrust specific performance is inferior to that of the turbojet.

This group of powerplants takes its name from the technique of air in the thermodynamic cycle. Some of that air—which would normally be compressed through bypass and turbine



compressor and turbine are taken out to the by-pass inlet, to be re-compressed by the primary air stream in the exhaust.

By-pass air is moved mechanically by a fan driven from the turbine stages of the primary engine. If the fan is multi-bladed, mid or large diameter, the engine generally is called a ducted fan type. If the fan is unbladed and of small diameter, the engine is called the by-pass type.

Just the essential difference between these two types is one of degree and not of principle. If high mass flow by-passes the engine, you generally have a ducted fan, if the engine by-pass is low mass, then you have a by-pass type.

How It Works—Diverting air around the engine increases the overall propulsive efficiency of the jet system. It does this by lowering the discharge velocity of the jet to a value which approaches the aircraft speed.

Propulsive efficiency of a jet system is a function of inlet and outlet velocities of the air. Efficiency reaches its maximum when the discharge speed is the same as the flight speed. Current turbo jet exhaust speeds are on the order of 1,600 mph. Transport or bomber flight speeds of 400 or 500 mph result in efficiency losses of 40 to 60% with such jet velocities.

The discharge velocity is lowered by the power requirements of the fan, which must be run by the turbine. This adds power and therefore jet velocity to the jet stream. The cooling effect of the by-pass air also tends to reduce the jet velocity, as does the mix of the primary and secondary gas streams.

Main Wares—There is a variety of

ways to handle the flow properly, but one thing is a constant in all cases: in the cycle where air can be diverted.

In example, the secondary air stream can be pulled out of the engine ahead of the compressor, after a couple of stages of compression, or at the exit of the compressor. It can be diverted into a common duct with the primary stream, or flow separately as even more ducting.

And it always, you don't get something for nothing. The by-pass engine is heavier, although as an installation of engine plus fuel for a given range, it will be lighter than a comparable turbojet installation. Operating benefits are similar—the engine is designed for a typical set of conditions, and if the conditions change, the engine has to be redesigned.

The mechanical drive for the fan is complicated, and as in the ducting which handles the diverted flow. Not enough is known about mixing of cold and hot gas streams to be able to predict characteristics of the engine with any degree of certainty.

History—As a class, the by-pass engine first came into being during World War II. Scandinavian studies by the Germans and British were carried to the stage of the engine.

In England, Metropolitan-Vickers developed its F2 jet turbine to the F3 ducted fan and the F5, an open fan (by-pass) engine. The French firm of SNECMA has recently built, tested and flown its small Argus ducted fan turbojet.

The R.R. Conway in the United States has developed the first model applications in the by-passing aircraft of tomorrow.



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While the data on any of these or other wire types is available on request.

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Crescent Wing

At the NACA air display at Farnborough, England, a model of the Handley Page jet transport was displayed, along with its wings. The main military strategy showing the crescent wing, at about the same time, David Kinnison, chief designer at Short Brothers and Harland, was presenting a lecture on wing developments, which contained a section devoted to an explanation of the crescent wing. Further, the lecture pointed the way to Handley Page development.

This new kind of wing planform—sometimes called the "variable" wing—is a layout in which the angle of sweep-back varies from a maximum at the root to a minimum at the tip. It can be a continuous variation, which produces curved leading and trailing edges, or a step function, which produces straight line segments of wing.

Advantages—problem-free example: streamlines—produces the curved surface of the crescent wing. **Reasoning**—Think of a highly swept wing with a load applied at the tip, such as would result from airspeed deflection. The wing starts to deflect, the point of load application is well behind the neutral axis of the wing. Thus the wing begins to twist. In the case of airspeed reversal, the load at tip increases due to this twist causes a loss of wing lift. This issue thus balances the increase in wing lift due to airspeed deflection.

The crescent wing outstays some of this problem, because the wingtip load is applied forward of the wing axis. Transverse deflection due to tip loads produces lift forces which add to those produced by airspeed.

There's a dividend in the crescent geometry which is paid off in reduced tendency to tip stalling. Reason for this is the reduced angle of sweep at the outer portion of the wing. Consequently, airspeed flow is in the low-speed portion of the flight range, and because the airspeed on a straight wing.

The Cost-You pay for these steady-state advantages is structural cost. The wing is heavier to a little degree because of the layout. Wingtips have

to be very thin at order to compensate for these lack of sweep.

Like layout can be expected to apply to wings of high aspect ratio, wings for airplanes in the bomber and transport category.

The pioneering work on the crescent wing was done by Handley Page during the war. In the postwar years, Handley Page picked up the chain of development and linked it to the H.P. 50 long-range bomber and the Handley Page H.P. 57 jet transport. A development—variable—lead from a Super bomber Airframe design and fitted with modified tail and a crescent wing—was designated the H.P. 55. This craft resulted after the pull-up from a low level, high-speed pass, indicating that there is more to the problem than aerodynamic layout.



Aero-Isoclinic Wing

The aero-isoclinic wing describes a structural strategy for maintaining constant wing incidence, regardless of loading on the surface, and regardless of flight.

The structure consists of making the wing structure with a combination of torsional stiffness, low in one axis, high in another.

This structural arrangement of load-carrying members permits a combination of wing bending and torsion which results in no unwanted change of incidence under flight loads.

One proposed layout of such a wing is to build a fuselage box which has the main beam in the left as possible, perhaps at 50% or 60% of the chord. Since normal flight loads are applied somewhat forward of the quarter-chord point, an increase in air speed will produce a sweep-back of the wing around that section box.

This is important in accelerated flight which holds up air loads on the wing above their normal value, such as a pull-out from a dive. In a steep climb with constant incidence in the unaccelerated wing, spanwise bending under load tends to reduce the incidence toward the tip. This is a simple matter of geometry, and occurs with a stiff, unaccelerated wing.

At the tip, the incidence decreases, incidence,



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they also lose lift. This loss of lift is behind the airplane center of gravity because of the wing angle, and the air plane feels a nose-up picking from the steep lift distribution. This leads to negative the pullout, and increase the lift further because of increased G on the aircraft. Further increase in lift loads the wing more, sheds more lift at the tip, produces more twisting from drag, and reduces the performance. The structure can follow.

►English Idea—H. H. Gardner, chief designer of Victory Aircraft, advanced one layout for an aerodynamic wing. It is, in effect, a structural hinge, placed at about the quarter span of the wing panel. The hinge line is so oriented that the loss of incidence from bending is balanced by increased incidence due to rotation.

The root portion of the structure is based on a beam which is spruce, extreme bending loads and low high-tensile stiffness. This is the "anchor" for the hinge.

The hinge is most important, and is a highly exact bending member with low torsional stiffness. To the outboard side of the hinge is instead a swept beam of high tensile steel. This beam connects two structural elements of high torsional stiffness with a hinge of low torsional stiffness.

The hinge area could be a two-way structure of aluminum, and the spar be tension spars used to keep loading flat. ►Oregon—The first thinking on the one-anchor wing was advanced by Prof. G. T. R. Hill, of University College, London. Gardner and Northrup mentioned the type in recent lectures, with the added indication that the biggest advantage would be gained when the requirements called for a wing of high aspect ratio.

This points the way to future applications of the new section wing in long-range bombers and transports, with sharply swept wings. Certain elements of multi-engine power, recovery airplanes designed for subsonic speeds, might also benefit from such a structure.

Hydrofoils and Skis

Tomorrow's flying boats, he thinks, large freight and passenger carriers as like fighters, will not resemble the stepped hull configurations that are familiar today.

Instead, landings and takeoffs will be made with combinations of floats to operate under water, and planing surfaces to skip across the top surface. These new water-lifting jobs for the aircraft designer go under the names of hydrofoil and hydro-ski.

Current interest in these developments stems from U. S. Navy position on the high-speed flying boat for fighter

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Fastener Problem of the Month

HUMAN CENTERVILLE

NOVEMBER, 1962



PROBLEM: Acceleration forces up to 40g are developed by the world's largest turbine engine, a device for testing high speed compressors on jet-plane parts and equipment. Built by the McKimsey Torry Corp. for The Naval Air Development Center, Johnsville, Pa., this giant gas-turbine which a gas-turbine horizontal, runs from dead stop to 175 mph in 7 seconds. When the 36" rim rotates fast enough, loads tend to pull the different sections apart. The fastening selected had to be not only exceptionally strong, but also able to hold fast in spite of the fluctuating stresses and the vibration involved.

SOLUTION: The largest tensile load on any of the unit's fast joints is 225,000 lbs. and is carried by eight one-inch bolts and self-locking vibration proof Elastic Stop Nuts. A strength test of a sample joint showed that the steel flanges failed first, without damage to the joint flanges or the bolts and nuts. An other vital spot is the air-tight seal between the two halves of the gas-turbine. These seals are clamped together with 688 bolts and Elastic Stop Nuts. In fact, all important sections of the engine—of the low and medium, the compressor, the gas-turbine, the three engine units supporting the gas-turbine shafts—all are fastened with Elastic Stop Nuts. The locking quality of these nuts during vibration enables them to resist loosening and destructive vibration. Where strength and designed security are needed, they provide it.

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front wheels into the runway surface, and the main shock strut takes up some of the impact energy during rotation of the logic member.

Flexible seating is entirely eliminated in the Dowty design, and there is no external plumbing of any type.

There is only one shock absorber—which supplies maintenance problems—and moving parts are at a minimum, over the wing.

Dowty uses magnesium alloy castings extensively in the gear, and that fact, plus the use of a single shock strut base mounted on a unit that is rigid in its approach, large wheel dimensions in external light in relation to the overall weight.

New Turbojet Alloy

A comparatively new cast aluminum alloy developed at Wright-Patterson AFB, Dayton, is being used for light weight, high temperature applications.

Known as M1 aluminum alloy, the material contains approximately 4% copper, 2% nickel, 2% magnesium and small percentages of titanium, manganese, chromium and vanadium, according to International Nickel Co., Inc.

Wright Aeronautical division of Curtiss-Wright Corp. is using the M1 material for the center main bearing support and nose/intermediate parts of its J67-Supersonic engine. Photo below shows J67 test cell.



TWO-STORY TEST CELLS

Double-deck test cells only one space at Curtiss-Wright Corp.'s Wright Aeronautical division. Photo shows J67-Supersonic engine stacked in its own two-story test house for pre-test use. Careful column bracing the building holds an examination of sound-damping installations.



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Figure 1 consists of two schematic diagrams, (a) and (b), illustrating a pressure point closed system. Both diagrams show a horizontal pipe with a valve in the center. Above the pipe, the text reads "PRESSURE POINT CLOSED WITH COIL ENERGIZED". In diagram (a), the valve is closed, and the system is labeled "PRESSURE POINT CLOSED". In diagram (b), the valve is open, and the system is labeled "PRESSURE POINT OPEN". Both diagrams include a pressure gauge on the left and a flow meter on the right.

Diagram illustrating the correct and incorrect use of a pressure port:

- Correct:** The pressure port is shown with a valve closed (indicated by a vertical line), labeled "Correct".
- Not recommended:** The pressure port is shown with a valve open (indicated by a horizontal line), labeled "Not recommended".

Diagram illustrating the correct way to open a pressure pot. The pot is shown in two states: 'Closed' and 'Open'. In the 'Closed' state, the pressure is 0 PSI. In the 'Open' state, the pressure is 100 PSI. The diagram includes a warning: 'PRESSURE POT OPEN - NO WORK WITH COILS EXTENDING'.

Designed specifically for low flow applications, where pressure drop is not a problem, these valves offer the rugged simplicity of direct acting ball poppets. They are designed for 1000 PSI operation (proof pressure 4300 PSI) and the solenoids operate at 12-28 volts D.C. Some models are immediately available from stock.



Pacific Division

Bentley Systems Corporation

Complete information will be provided on request



GAGES INSTALLED on underside of FWF Borecut wing. Large circle (lower center) is enlarged view of the least load gage installation.

Simple Gage Shows Plane Stress

A simple device has been developed at the National Bureau of Standards for safety-checking aircraft structures. It is a limit load gauge that indicates visually whether basic structural components of operational aircraft have been stressed beyond values which are considered safe.



LIMIT LOAD GAGE: 5 mils compression. A, arm; B, cone; C and D, gage points; E, steel wire tip. Tip E is set to overlap horizontal part of cone B by distance equal to the elongation to be indicated. When setting is exceeded, as it has been in this photo, cone springs rise of cone.

placement of the core and the core development.

►How It Works—Operation is simple. Arm is initially set above the cam in a cocked position. The gap indicator cocked when elongation is such that arm fits just the cam edge.

The page is mounted on a structural member by means of two drilled and tapped holes at the desired location. The holes are spaced to insure that the wire will contact the page. The con-

also sitting is obtained by placing the arm up on the horizontal arm surface, then rotating the arm until the arm springs clear.

* The required overlap setting can be determined from a calibration curve of the page, Young's modulus of the material to which the page is attached and the strain level at which inhibition is desired.

► **No Wear Effects**—Because appreciable wear of the gun or arm is avoided.

give a change in zero setting and in the calibration curve, were both well performed.

The gage was mounted on a spectrometry variable line unit with an Avery fatigue testing machine, then given a pushing load a little lower than the value required for the gage to indicate. After 10,000 cycles, new top and case were examined for wear and the calibration also checked. There was practically no evidence of wear, and the calibration error wasing the same.

But it was found that the page points would loosen if they were not initially seated correctly.

► **Setting Not Hard**—NBS checked the accuracy with which the pigs could be set by different installers. A set of stencils and a calibration curve were given to each person tested, to set the gage. The gage-indicating level was determined by applying a tensile force to a test bar causing the error.

After a few trials, it was shown that an operator, entirely unfamiliar with the page, could set it to a given value within 300 psi.

* **Agreement**—The load limit gage generally is mounted on the tension surface of a beam subjected to bending. Effect of bending was determined, as well as accuracy of the correction necessary to account for the condition that the eye line is normally $\frac{1}{2}$ in. from the beam surface.

Tests showed that to have the gage arm drop at a surface stress S , it had to be set for a stress of $50(C+4)/C\%$, where C is the number of inches from the beam tension surface to the neutral axis.

In the untopped lighter plate tests, the gages were mounted at three positions on the wing. On the wing surface, directly under gage locations were placed two resistance strain gages. After flights of simulated disc bombing and strafing, the recorded outputs of the strain gages were compared with the strain values provided with the load heat gages and found to agree within 18%.

Centrifuges Test Missile Assemblies

A series of certainties that can be used for operational testing of components and assemblies is under development by the Raytek Co., 4320 Hella St., Oakland 8, Calif.

A typical Rodent unit now being installed at a graded cylinder development center will test components up to a weight of 600 lb at centrifugal loadings of 60G. Lighter specimens can be loaded to higher values; test pieces up to 6 ft long or of 24-in. section can be tested.

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signal outputs and eight electrical power leads, a control cable, a waveguide and high pressure hydraulic, air and fuel connections. These run from the centrifuge test mount to the remote test and control console.

Hydraulic drive of the rotor gives a fully variable speed regulation. Safety controls prevent accidental starts unless the pits are clear of personnel, emergency stops are handled by either an both hydraulic and mechanical braking systems.

Percival Developing Jet Copter Engine

Development of the lifting unit has a jet-powered family of helicopters as well as other uses, at Ferret Aircraft, Ltd. of Luton, England. The company is stressing that the rotor-plus rotor combination allows it to build the complete helicopter. With the limit of the rotor power, designers can then turn to the limit of structural containers for the accommodation of other passengers or cargo as both.

The powerplant will be a special gas-turbine turbine, fitted in or near the nacelle. Discharge high-pressure gas from this unit will be piped through hollow rotor blades to the tips, where it will be ejected at high speed. The reaction to this discharge will rotate the blades. Afterburning will not be used in the new engine.

Pinneel will test the blades and powerplant in a special underground maze test.

Building Program Pushed by McDonnell

New facility projects are being pushed at McDonnell Aircraft Corp., St. Louis, to achieve an integrated production and experimental plant for aircraft and related services.

Already completed is a new 53-ft-long hangar, scheduled for partial occupancy in December. A new parking facility adjacent to the hangar is now ready for partial use. Another completed project is a microwave laboratory for electronic tests.

Under construction are a two-cell aircraft propulsion laboratory and a low-speed, three-story windtunnel, each costing \$1 million. The propulsion lab is targeted for completion by December and the windtunnel by March of next year.

The preparation lab will have an associated sleep area accommodating about 50 people. Top left of the wind tunnel building will be used as an operations base. Model will be lowered from the operations loft to the square test section.

New!
THOMPSON
SLOTTED
RETREAD



Alternating slots . . . a new design principle developed by Thompson Aircraft Tire Corporation over a year ago . . . retains the side-slip resistance of straight rib design yet lengthens wear by providing more even distribution of tire load. Slots are tapered in depth—both at sides and ends—to reduce the hazard of picking up bolts, rocks and other cut-eroding objects.

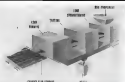
Superior performance has been established in tests by 30 airlines on over 2,000 Slotted Retreads. No other tread design provides such longer wear plus runway efficiency comparable to the new Thompson Slotted Retread.

Thompson submachine guns are safe... over 100,000 have been used on airplanes throughout the world!

THOMPSON Aircraft Tire CORPORATION



ASSEMBLY of electronic components will be done automatically on a GE-developed machine similar to this. First is to be delivered in late 1953.



COMPONENTS such as conventional type resistors and capacitors will be tested, and have their leads cut and formed on a machine like this one.



PRINTED CIRCUIT This plate is how on which assembly machine will mount their parts.



SOLDER DIP will serve components and make electrical connections, after which their parts will be mounted in plastic cases, as illustrated above.

Automatic Factory Near for Electronics

GE developing machines to prepare, test and place conventional components in printed circuit units.

By Philip Klass

General Electric is developing machinery that should soon make possible the completely automatic manufacture of printed-circuit electronic assemblies using conventional-type components.

The electronic test, handling, and placement of conventional-type components in printed-circuit boards was made by R. A. Gish of the Signal Corps Engineering Lab in a paper delivered at the recent National Electronics Conference in Chicago. It was particularly noteworthy because the electronic in-

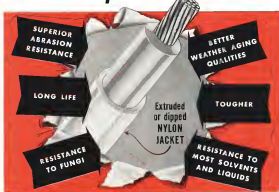
dustry, by its very nature, has long defied mechanization. GE expects to deliver the first experimental version of the late automatic factory machines late in 1953, according to a spokesman.

■ The Semi-Automatic factory use of electronics in air, ground and sea applications, and the advent of ever-growing guided missiles which are crucial to the defense of the United States, has long worried the experts. They recognize the high labor content which goes into electronics assemblies and they wonder where the U. S. would find sufficient manpower to meet the needs of a hot war. That is why there is a lot of activity interest behind the Signal Corps-GE program.

The Signal Corps has recently taken other steps to increase production of mechanized electronics production. The obstacle was the increasing use of test machines to replace vacuum tubes. Vacuum tubes have long been produced by fully automatic techniques, the new machines have been manufactured by semi-laboratory methods. This requires great Signal Corps contacts to GE, Raytheon, Sylvania and RCA to develop automatic machines for producing, assembling, and testing machines.

■ Advantages—Here is what makes the new automatic factory type equipment under development by GE an attractive. ■ New production—Automatic machinery can be operated for 24 hours a day, seven days a week, with no time out for lunch, rest periods, or shift changes, and only occasional down-

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CATALOG

For Men in Aviation Manufacturing and Maintenance



Aviation Materials — Components and Assembly Line

Published by **Graybar Electric Company**, 274 pages. This 5½" x 11" volume, printed on coated stock and illustrated throughout with full-color, half-hundred of electrical items in constant use in components and on the assembly line. Written and edited for the convenience of men in the aircraft field the book represents the most comprehensive catalog now available to this highly specialized industry. In addition to text data, illustrations and

specifications of parts and materials, the book carries many reference tables of great value and convenience. Tables on wire, for example, list AN sizes, AWG sizes, number of strands, approximate bare diameter, shipping weight in pounds per thousand feet, maximum over-all diameter and nominal copper weight in pounds per thousand feet. More than 200 separate items are listed in an alphabetical, easy-to-find index.

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20-22

This unitless function generator can be used to simulate the effects of backlash, dead time and lost steps in real time using computer studies of some system design problems. Made by **Computer Corp.** of Iowa, the new Model NEL-2 allows computer input signals to be continuously varied by preset adjustments. Drive unit is used with such timing computers as the REAC, GEDA or RDA, the latter manufactured by CEA, 149 Clark St., New York

time required for their maintenance.

- **Improved quality.** As long as the machines function properly, every assembly should come out correctly and up to required quality standards. This should in turn reduce scrap and rework.

- **Flexibility.** Because manufacturing instructions for the machines will come from punched (IBM type) cards on tape, a production line can be quickly converted from manufacturing one type assembly to another. Changes will require no "change time" for the machine, and the line can come up to full speed almost immediately.

- **Low manpower.** Practically all of the hand labor operations associated with present-day manufacturing methods can be eliminated and non-skilled personnel can be used where operators are necessary.

- **Outgrowth of "Auto-Assembly."** — GCI's program is a logical continuation of the auto-developed Signal Corp. technique called "Auto-Assembly." Auto-Assembly uses a fiber mounting board, or "card," on which are printed in etched the connections necessary to interconnect the components.

In its earliest concept, conventional-type components were mounted by hand on the card by inserting their leads through small punched holes in the card. After component installation, the entire bottom half of the card was quickly folded into a hat box of solder, securing the components and connecting them electrically to the printed connections.

This technique has proven attractive because it eliminates:

- Major portion of hand labor operations (soldering interconnecting wires).
- Chance for assembly errors and component misplacement.

As a result of this technique, Gerbely said, one manufacturer cut his rejection rate to



ANALOG AID

This unitless function generator can be used to simulate the effects of backlash, dead time and lost steps in real time using computer studies of some system design problems. Made by **Computer Corp.** of Iowa, the new Model NEL-2 allows computer input signals to be continuously varied by preset adjustments. Drive unit is used with such timing computers as the REAC, GEDA or RDA, the latter manufactured by CEA, 149 Clark St., New York

HEADQUARTERS

FOR

AIRCRAFT ACCESSORY DRIVES



Design Development Prototype Production Quantity Production

Just a line of the many drives produced by Western Gear Works for aircraft-engine accessories are illustrated on this page.

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1/20 of their experience as land surveying operations.

General Electric itself applied the new technique automatically in a part of its line of television sets only in 1951 and has made increasing use of the auto-assembly technique, in home office, radioelectronics.

Next Step—The Signal Corps has now taken the next logical, but the most difficult, step toward complete automation. That is the automatic place work of prefabricated components on the printed-circuit card. This might not seem too difficult until one examines the problem more closely.

The equipment must be designed with sufficient flexibility to handle a variety of different components and be capable of changing from one type assembly to another in short order. A more fundamentally difficult problem arises in the components themselves.

Component manufacturers, long accustomed to meeting tight tolerances on the electrical characteristics of their products, have never attempted to precisely maintain the outer physical dimensions of their components. When components used by automatic positioning are within 0.005 in. for automatic installation, variation in component dimensions can present a major problem.

Conventional Type Components — The Signal Corps divided by build its automatic factory around conventional types of resistors, capacitors, etc. because these components are reliable and proven. Considerable effort has already gone into improving their quality and reliability.

At least for the present, the Signal Corps appears to have rejected the printing of graphic and silver patterns on the filter card to create resistors and capacitors, because these techniques are not yet sufficiently accurate or reliable for military equipment.

(Dr. John J. Savage developed an automatic machine in the late 1940's which could turn out five-hole-punched circuit, printed-component superlatively-dimensioned at the rate of 500,000 sets a year. Only the tubes, capacitors, etc., electronic components and the local speaker had to be installed by hand.)

The New Machine—General Electric is developing three different types of machines for the Signal Corps.

Component Preparation. This device will test each component electrically, reject defective, and then cut and fold the leads as required, delivering the component to the Component Carrier.

Component Carrier. This device will load components into trays, code the trays to identify the specific type component, and deliver the trays to the Component Assembly machine.

Component Assembly. Printed cir-



In This NEW Bendix-Pacific TELEMETERING COMMUTATING SWITCH

Consolidation of telemetering subcarrier oscillator input voltages or pickup output at high sampling rates can now be provided with this new Bendix-Pacific TSC-18 Commutating Switch.

The TSC-18 Commutating Switch is a three pole switch having 40 contacts per section and shunting type contact wiping. Non-shorting type operation may be obtained by connecting in a thermocouple contact giving 30 contacts in each section with 60% duty cycle. This wiping is adjustable for synchronization of all sections.

Long life has been engineered into the switch through the use of heat treated precision metal contact pins and wipers. The contact plate and rotor are completely enclosed in an aluminum housing which is attached to a small permanent magnet motor having an integral gear train and governor.



SPECIFICATIONS

Motor Voltage: 6, 12, or 24 volts DC.
Motor Current: 350 to 500 ma.
Capacitive Load: 200 p.f. at 1000 cycles.
Allowable gain: 2.5 mV.
Motor to motor slip: 10.1 mV.
Order to motor slip: 10.1 mV.
Order to motor slip: 10.1 mV.
Temperature range: -40°C to +100°C

Acceleration: 50 g's along any axis.
Vibration: 50 g's along any axis.
Frequency: 20 cps to 100 cps.
400 cps along any axis.
Shock: 25 g's max. duration.
400 cps along any axis.
Weight: 1.5 lbs.

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information



TO REASON, TO WORK, TO SERVE, AFFORDANCE

cut cards, with interconnecting conductors and pre-punched holes to assure component leads will be fed to this machine as well as the type of testing tested components. This machine will lower components individually, positioning the printed-circuit card to receive component leads. Later the card will be automatically conveyed to a hot-solder bath for dipping. The completed card will then be ready for installation in its plug-in chassis.

The Signal Corps has asked for pulse (rotational) sensitivity as well as rectangular positioning of components on the card. This feature will permit more compact assemblies but will probably

also make design loadouts at GE. ■ **Partial Gosh—GE** says it is shooting for a component placement rate of at least 30 per minute. Making allowance for machine load-out time, this would enable the device to turn out 2,000 10-component cards per day. A single machine could turn out 50-component assemblies at the rate of 750 per day, GE estimates.

Dr. W. R. G. Baker, GE vice-president and general manager of its electronics division, says that the company's steadily increasing design capacity is the major problem. The other two obstacles "are already on the drawing boards," Baker says.



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MIL-S-915A	Bar	4130	Round, Square, Hex's, Flat, Ribbed, Anodized, Normalized
AMS-924	Bar	4240 Modified Anodized Round	Anodized & Normalized
AN-CO-9-685	Strip	4130	
AN-S-11	Strip	1380-95	

AIRCRAFT STAINLESS

Specification	Shape	Analysis	Condition, etc.
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	Flat	Type 301	30 and 316
	Sheet	Type 304	30 and 316
MIL-S-9191	Sheet	Type 316	30 and 316
	Flat	Type 321	30 and 316
MIL-S-7120	Bar	Type 303	Round, Square, Hex's
AMS-9110	Sheet	Type 285	30 and 316
AMS-9321	Sheet	Type 310	30 and 316
AMS-9315	Bar	Type 416	Round, Square, Hex's
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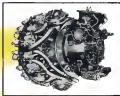
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valve adjustments on the TVOR for frequency which can be tuned to any spot in the 500 to 100 mc. band. Any three heater stations simultaneously can be set up on the equipment, the manufacturer says.

Low cost TVOR, designed to make "all-weather" airports out of sand (except) and low-density foreign airfields is an outgrowth of an Air Transport Association project completed earlier this year. ATA built a TVOR largely from existing components and tested it to prove practicability of such a low-cost airfield base. (Aviation Week May 5, p. 65 June 9, p. 68) Wilson Electric Co. has mounted its own TVOR test and Collins Radio is reported working on a TVOR.

Meredith Electronics' TVOR is available on 90-day delivery, the College Park, Md., manufacturer says.

New Potting Resin Quick to Harden

A low-cost resin which has good storage properties without adulteration has been developed by the National Bureau of Standards for calibrating or "potting" electronic assemblies.

Designated the type AN-5 casting resin, NBS says the resin has good physical and electrical properties at both high and low frequencies. The new resin was developed to replace the previous NBS developed resin which used high-cost 2,5-dichloroterephthalene.

The new resin can be cured (hardened) at room temperature within several days. If the temperature is raised to 100°C, the resin will set in about 2 hours and be completely cured in 20 hours, NBS says.



Navy Gets New Instrument Trainer

Navy's first twin-piston-engine instrument flight trainer has been completed by Engineering and Research Corp. The trainer will go into service at Navy's Corpus Christi all-weather flying school.

The design does not make the flight characteristics of a specific type airplane and for that reason is called a flight trainer rather than a flight simulator. However, the Riverside, Md., manufacturer has spent no effort to provide realistic loads in cockpit firing and in the new trainer's "light" characteristics.

For example, Eric says, the trainer at the first 10 sec cockpit control tests which are dependent and color-coded according to their function. It is also the first to use a new radio aids panel and flight plotting board developed by the Navy's Special Devices Center and built by Turbaco Products, Inc., of Hagerstown, Md.

The radio aids unit provides for re-

ception of two range systems, either the low-frequency A-N type or the VHF omni-range type. The trainer also provides simulated distance measuring equipment (DME) and instrument approach facilities, either ILS or GCA.

The Eric trainer can also simulate a multitude of engine, equipment, and instrument failures to give the student pilot a realistic on the ground experience in coping with emergency flight conditions.

Eric says it has designed the new trainer for easy maintenance by providing:

- Snap-on panels on the computer console
- Built-in test for checking computer voltage rates
- Terminal board beyond on interior wiring for handy voltage checks

Engineering and Research Corp. is working on other Navy trainers, including several twin-engine flight simulators.

"Operation Push Button"



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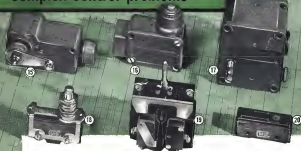
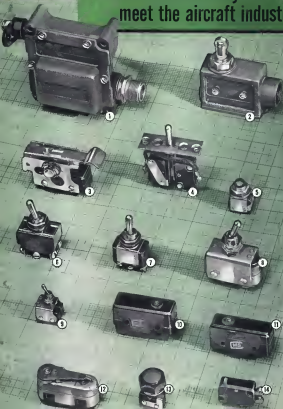
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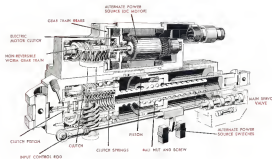


- 1 Sealed waterproof housing with positive rotary actuation of one or two single-pole double-throw switched switch units of the type shown in Figure 11.
- 2 Rock-plunger type switch operated by rams or slides. Meets AN3111 and MIL-8834 specifications.
- 3 Switch actuator for use with single switch units. Button on side returns switch to "off" position while actuator lever remains depressed.
- 4 One of many two switch assemblies with toggle actuation. Unit shown is AN3034-3.
- 5 Push button switch assembly with panel mounting. To attach one or two single-pole double-throw switch units.
- 6 One of the many standard "AN" type double-pole double-throw toggle switches available in many small arrangements.
- 7 An "AN" type single-pole double-throw toggle switch. Available with several circuit arrangements.
- 8 A special panel mount toggle switch assembly with a hermetically sealed switch unit as shown in Figure 12.
- 9 Ultra small toggle assembly with two single-pole double-throw miniature switch units. Designed for small space requirements.
- 10 Standard precision double-pole double-throw snap action switch in the field. Can be enclosed in one of many available protective enclosures, or may be used in a wide variety of switch-outlets.
- 11 Standard AN3016 single-pole double-throw switch, also available enclosed in many protective housings and switch outlets.
- 12 The first precision hermetically sealed single-pole double-throw switching unit designed to meet the requirements of altitudes encountered in aircraft control switch-outlets and enclosures are also available for this base switch unit.
- 13 Sealed panel mount push button assembly. The single-pole double-throw switch unit is mounted in a hermetic shell to be detachable for panel mounting of the push button assembly in the panel.
- 14 Small single-pole double-throw, V type precision snap-action switch conforming to AN3011 specifications. Enclosed in a wide variety of switch-outlets and housings.
- 15 Sealed housing with rotary actuation and roller arm lever. Sealed contact spring. Designed for enclosing one or two V type switches.
- 16 The housing is designed for use with V type ratchet, sealed plunger actuator.
- 17 Light weight, rugged housing for one or two hermetically sealed switch units of the type shown in Figure 13.
- 18 One of the many types of switch actuators for use with base switches such as the type shown in Figure 13. Panel mounting design.
- 19 A special switch assembly of multiple banks of V3 type switches. Toggle actuator.
- 20 Special non-polarized precision switch unit for high duty loads. Custom precision magnet to blow air away from contacts.

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MAKERS OF PRECISION SWITCHES
FREEPORT, ILLINOIS

A DIVISION OF
MINNEAPOLIS-MONEYWELL REGULATOR COMPANY





GET NEW DESIGN FREEDOM WITH AEROPRODUCTS SELF-LOCKING ACTUATORS



APPLICATIONS

- Hydraulic Control
- Jet Engines
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- Variable Wing Incidence
- flap Actuators
- Aileron Control
- Variable Wing Sweep
- Bomb Bay Doors
- Cargo Doors
- Landing Gear
- Turret Control
- Cannon and Gun Control



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Designing for tomorrow*



AeroProducts

ALLISON DIVISION • GENERAL MOTORS CORPORATION • DAYTON, OHIO

Instantaneous and positive in action, the new AeroProducts actuators automatically locks itself in any position. This self-locking feature gives absolute control of any movable part, eliminating design limitations that have heretofore prevented development of many aeronautical advancements.

AeroProducts actuators may be employed in series or tandem to give identical, synchronous control of more than one movable part. The basic design is uni-

versely variable for hydraulic, pneumatic, electric or manual operation, or any combination of these.

Designs are already in use for variable control surfaces and jet engines. Others are in process for guided missiles and various commercial applications.

Actuators now in production are: Sixty-Pound 7040 Hydraulic Rod
McDonnell F24 Horizontal Stabilizer
Others announced

FILTER CENTER

► **Callias to Show New Anticraft**—Callias Radio will soon reveal a new field with an automatic pilot built around its Integrated Flight System (Zero Reader type flight director). Design will permit an IFS to be converted into an automatic pilot by adding a zero amplifier, servo actuators, etc. Prototype is being installed in company's Beechcraft for demonstrations to military and airline personnel.

► **Priorities to Use Radio**—Ellen search radar for use in storm and terrain warning has been ordered for the Saunders-Roe Princess flying boat, according to the British magazine, Flight.

► **Must Close the Gap**—"We must close the gap between the developer (of military electronics) and the user... (now) a matter of several years... (to) buy or additional technological lead time over our adversaries." Maj. Gen. George I. Buck, Chief Army Signal Officer announced at the recent National Electronics Conference in Chicago.

► **Minike Gaudert-Norden** Inertial systems, Inc., manufacturing associate of Norden Laboratories, has delivered its first production version of a "computer cut for an aircraft fire control system" to Navy BuOrd. Photo of the device is a 4-ft. shipping case indicates it may be ship- or ground-based, possibly for guidance of guided-to-air missiles such as BuOrd's Terrier, built by Curtiss.

► **New Airfield Components**—Small tech generator suitable for servo system stabilization has low starting torque and output voltage up to 1.5 volts per 100 rpm. Unit is about 24 in. long by 14 in. dia. (Curtiss Laboratories, Inc., 1255 Sunrise Place, Dayton 7, Ohio).

► **Charterpool** pressure relief which contains lock-in relay to prevent die plunging contact short under vibration is available in Series 453. Unit can handle up to 5 amp. and can be set to operate at any absolute or differential pressure up to 49 psi. (Curtiss Laboratories, 17 Court St., Manchester, N.H.)

► **Expanded** wide-meshed resistor with extremely low thermal expansion, said to be capable of withstanding extreme humidity, are available in 1-to-5-ohm ranges, 1 to 2 watt rating, for operation from -65 to 125°C, or up to 190°C if needed. Manufacturer says units are most appropriate military specs. (Corona Mfg. Corp., 2240 Sepulveda Blvd., Los Angeles, 64, Calif.) —PK

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PRODUCTION



U.S. Refinements

Customary to popular belief, most major advances of the heavy forging art have come from this country, not Germany.

It is true that heavy hydraulic presses for die forging were first built in Germany, but production on the German press—over 16,000-ton units and a 33,000-ton machine—was limited to parts of relatively simple configuration.

Where custom of these machines became known, an experimental plant was set up at North Griffin, Miss., equipped with one 18,000-ton large press built by Moors Machine Co., Pittsburgh, Pa. Operation of this facility was begun by Wyman-Gordon Co. for the Air Force, in 1946. Forging results accomplished there, roughed with the demands of the production program, led to the heavy press program calling for 17 large large and extrusion presses.

Until recently, all the heavy parts forgings produced in this country were turned out on Wyman-Gordon's 18,000-ton press. Parts produced have been large and intricate and go beyond German accomplishments in similar equipment. Experience gained points to even greater achievements on the larger units to come under the heavy press program.

Progress Made in Heavy Forge-Press Art

Know-how gained with 18,000-ton machine will prove valuable on new Wyman-Gordon units.

By Irving Stone

North Griffin, Miss.—A new era in the metal forging art is beginning to shape up. In this small New England town, the Air Force is steadily rearing a key segment of its heavy press forging program—hurdled to meet aircraft structural requirements for stronger, tougher, larger and more complex components in the fast-changing advanced jet (Aircraft Week July 7, p. 38).

Then North Griffin facility, now being operated for USAF by Wyman-Gordon Co., already boasts the largest large press in the country—an 18,000-

tonner, which has been squeezing out big parts for military aircraft and is given as a production base. Plans for which these forgings have been made include the Boeing B-52 and B-47, Republic F-84, Douglas C-124, and many other Air Force and Navy aircraft. Components have also been made for Allison, Westinghouse, Pratt & Whitney, Goodrich, and Bell.

Now the plant is being expanded to accommodate two new large press units—a 35,000 and a 50,000 ton unit—and their supporting equipment.

These large machines, first of the

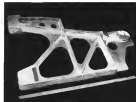
heavy forge presses scheduled to go to work under the Air Force's expanded program are expected to begin operation in the first quarter of 1952. The 35,000-tonner will be the first to operate, leading the 50,000-ton unit by a couple of months. Holes for the machine have already been excavated and the concrete will be poured very dry.

Both machines are being constructed by Hydrospring, Inc. They will be the first of a new design, with actuating cylinders below ground instead of on top of the machine. This arrangement will provide a stabilizing force against the press bed and also allow shorter piping. For greater strength, the press will be constructed entirely of forged steel except for the cast steel cylinders

B-47 Forgings . . .



Reinforced Segment
15 lb., 490 sq. in., 145 aluminum alloy.



Reinforced Segment
25 lb., 425 sq. in., 145 aluminum alloy.



Reinforced Segment
120 lb., 721 sq. in., 145 aluminum.

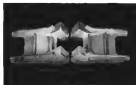


Wing Rib
179 lb., 547 sq. in., 145 aluminum.



Landing Gear Trunnion
195 lb., 546 sq. in., 145 aluminum.

Navy Fighter Forgings . . .



Wing Beam
51 lb., 127 sq. in., 715 aluminum alloy.



Wing Root Fitting
165 lb., 560 sq. in., 715 aluminum alloy.



Wing Fitting
15 lb., 151 sq. in., A286-X stainless.



Wing Beam
410 lb., 1,590 sq. in., 715 aluminum.



Wing Box Beam
545 lb., 3,760 sq. in., 715 aluminum.



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J-3E Wing Fitting
Weight, 29 lb., 718 aluminum alloy.



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Weight, 48 lb., 245 aluminum alloy.

on the 35,000-lb. unit, which was cast from Inco.
► **Expanded Facilities**—In the existing Wyman Gordon North Grafton setup, in addition to the 18,000-lb. Mesa large press, which carries the bulk of the work, there is a 7,500-lb. Inco Genex 18-tonne press, ready to go into operation for the forgings as soon before these normally made on the Mesa. There is also a 1,500-ton Wood press used mostly for preliminary operations such as cross-hatching, finishing operations in open die and drawing. These facilities are housed in 82,000 sq. ft. of plant space.

In the expanded logic shop there will be an additional 18,000 sq. ft. of building stock storage and casting, affording a total floor area of 265,000 sq. ft. Process and maintenance quarters for tool and die shops, heat-treat and sawing will add another 131,380 sq. ft. An office building for housing an engineering staff, laboratory, administration, hospital and cafeteria will cover 81,672 sq. ft. Two new pump rooms will add 27,500 sq. ft., powerhouse another 18,750 sq. ft.

► **Progress**—Gryllid-Wyman-Gordon has been squeezing out extreme end engine parts on the 18,000-ton press since the latter half of 1946. These have not, in the main, been round rail types, but have involved some unusual configurations, and have been made for aircraft and engines of numerous marine machines engaged in military work. A wealth of know-how has been accrued later in the heavy forging art.

This does not mean that the new 35,000- and 50,000-ton presses, with almost double and triple the force, respectively, of the 18,000-tonner, will enter in a long range that can be expected to produce infinitely large or complete integrally stiffened wing panels anytime soon. This sort of achievement, despite loose talk that has been bandied about, isn't in the cards until—and perhaps not even for a very long time. The smaller forgings

U-S-S Carilloy steel springs soak up 8 million lb.-ft. Torque!

**Alloy springs cushion
tremendous mechanical shocks
in 200-ton short-circuit generators
... save expense of forgings**

■ In testing high-voltage circuit breakers, explosions at Westinghouse Electric Company occasionally shatter large motor-driven generators. Each of these test specimens is normally rated 155,000 kw, but provide short-circuit currents in excess of 162,000 amp, instantaneous peaks of the effect wave, corresponding to about 1,500,000 kw and equivalent short-circuit duty. Such operations cause tremendous mechanical stresses to build up inside each machine.

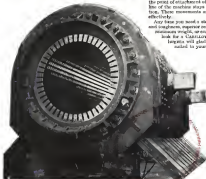
These stresses create a torque that tries to twist loose the 200-ton stator assembly.

But no damage is done! These powerful machines are mounted on U-S-S Carilloy steel plate springs that cushion the shock and then damp out any vibrations that follow. The springs must absorb these terrific shock forces loads as often as 48 times an hour, so a tough, very durable steel is needed.

Forged springs were considered first. But GE engineers, with the cooperation of United States Steel Metallurgists, found that a rolled alloy steel, U-S-S CARILLOY 4340, provides the required mechanical properties at much lower cost. This steel is tough, even though extremely hard, and it secures good weldability at 40,000 psi, as required in this application. In addition, it is easy to heat treat.

The CARILLOY steel is giving excellent service. Under the most severe short circuit, developing a whopping 8 million lb. ft. of torque, these machines absorb 50 or more ways at the point of attachment of the springs. And the sand castings of the machine stays within 20 psi of the nominal position. These moments are sufficient to maintain the shock effectively.

Any time you need a steel that will provide high strength and toughness, superior resistance to shock and fatigue with minimum weight, or any combination of these properties, look for a Carilloy steel. Experienced U-S-S Metallurgists will gladly help you choose the one best suited to your requirements.



At General Electric Company's new switching development laboratory, this 1,600,000-lb. short-circuit test generator is protected from mechanical damage during electrical tests by plate springs made of U-S-S Carilloy steel. Rolled CARILLOY 4340 stands up under the repeated shock forces built-up during these conditions, and it costs less than forgings.

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still pose a lot of problems that have to be solved.

► New Problems Ahead—However, the new process will be invaluable along the expensive road, making new opportunity for larger single pieces, closer tolerances, thinner walls. Operators will have to learn a lot about bagging capabilities and actually done machines will be experimental pieces in a further extension of the forging art.

Airframe and engine men, too, will have to ease into the new forging regime design wise. Next design subjected today for execution by forging are considered reasonable, but with the new houses, close tolerances will have to be maintained between designers and operators to establish a common ground of understanding as to the possibilities and limitations of the forging process on the big machines.

This essential teamwork between the two parties will begin with the acceptance, progress through the drawing stage, and continue right down to the forging operation.

► Greater Interest Seen—With the new houses on the way for Wayne Gordon and other operators, interest in designing into the large forge press has been stimulated. Initially, many automobile men were hesitant to get all their production eggs into one basket—a limited number of heavy forge facilities—because machine breakdown could mean a serious curtailment of production. But the approaching availability of a large number of the heavy presses has worked to dispel designers' doubts, and reports are that if the big-tonnage were available today, operators would have a flood of orders for large airplane forgings.

► Other New Houses—In addition to the 35,000- and 50,000-lb units for Wayne-Gordon, machine-size large



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Utica is proud of its part in the forging of turbine and compressor blades for jet engines. And now a new step has been added. An important defense task has been taken from other hard working shoulders—and the country's all-important blade production for jet engines thus speeded and increased.

Utica's facilities now include an entirely separate and extensive plant for the finishing of blades. Great

precision grinders and broaches cut roots into hard-to-work metal. Automatic polishes bring airfoil characteristics to perfection. The finest of metrological equipment gauges the finished product.

This is not work that can be done by rote. Many of these are "first-time" processes. They require the advanced and specialized knowledge of metallurgy and metalworking for which Utica stands.



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* PERFORMANCE

Engineered for Production

* Bolt screw units designed and manufactured by Vard—exceed up to 95% efficiency—bring a substantial savings in weight and R.P. requirements.

Rods and pinch diameters of most of Vard Bolt Screws are sold to tolerances of .0004. This fact coupled with the quick bolt principle, permits faster screw at greater loads.

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Designers and Manufacturers of:

- Bolt Screw Assemblies
- Screw Assemblies
- Electrochemical Anodes
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- Non-Spark Motors and Wave Generators

panies are going to Aluminum Co. of America at Cleveland, 25,000- and 35,000-tonners to Kaiser Aluminum & Chemical Corp. at Newark, Ohio, and to Harvey-Michael Co. at Tintonia, Calif.

These right heavy fingers are not the only big machines in the works. Nine big extrusion presses ranging from 8,000 to 20,000 tons will be put into plants operated by Kaiser Heavy-Aeros, Reynolds Metals Co., and Curtiss-Wright Corp.

► **Materials, Parts—Weld** at the North Grafton plant is devoted solely to aircraft parts—mainly airframe components and some engine parts. Aluminum alloys being forged include 748, 738 and 735. Some 515 has been forged at the plant. Magnesium alloys used are AZ60 and ZK 60.

No titanium alloys have been forged at North Grafton, work on that metal so far having been restricted to Wyman-Gordon's Waco, Mass., plant on an experimental basis. Large-piece forgings of titanium will not be transferred to North Grafton until the Air Force directs the shift.

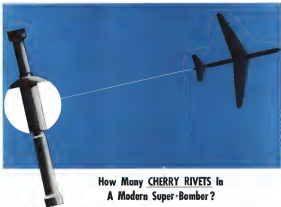
Parts that have been or are now being made in aluminum and magnesium alloys range in weight from about 25 to 300 lb. Surfaces of about 1,000 sq in. in the heaviest ones processed on the 15,000-ton press, but this isn't a hard-and-fast figure—it depends on the forging configuration. Components include spars, beams, ribs, booms, bulkhead segments, control surface, mainframe, rotor, heavy fittings, engine section, helicopter rotor, grip plates and landing gear cylinders, forks, transmissions, and wheels.

► **Longer Press—It** is possible to make parts of considerable length on the press. One experimental T section spar for a bomber is 17 ft. long and weighs only about 100 lb.

Use the new press with this 32-1/2-ft. bed, greater possibilities are opened up, even though the bed isn't a direct reduction of the forging rate obtainable. Size will depend mainly on the geometry of the part and the material used—the lighter the strength, the greater the pressure required. For forging 738, 15,000-40,000 psi pressure is required.

Meanwhile, forgings up to 20 ft. in length are now as possible with the new Air Force presses, and those will, too, are in the picture if the machine will hold up. There is a possibility of going to lengths of 40 ft. and on some types of work even to reach greater stretches through the use of multiple dies put through the press successively. But this capability is merely conjecture—the answer still lies in the problem discussed, taken.

In the final analysis the controlling factor for forging length will not be



How Many CHERRY RIVETS In A Modern Super-Bomber?

In aircraft construction, Cherry Blind Rivets are virtually indispensable. Their practicability is demonstrated by the fact that more than a quarter-million of these ingenious rivets help stitch various components of the modern super bomber—in as many as sixty thousand an hour in the construction of a four-engine transport. Their use makes possible refinements of design and assembly methods of control surfaces and other components that speed fabrication with big savings in cost.

The use of Cherry Blind Rivets has spread from aircraft construction to all industry. Designers and production engineers find them especially applicable in blind spots because Cherry Blind Rivets are installed by one man from one side of the work and eliminate the helper used to tack other types of rivets. Cherry Rivets are used in double-sheared structures, box sec-

tions, tubes, ducts, and other hard-to-reach places. Their time and cost saving features are used to advantage in railroad cars, houses, trailers, household appliances, automobiles, and other equipment where reduction in assembly time can be substantial—where improvement in product is important.

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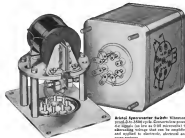
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wide frequency-range precision inverter
can also be used as a precision synchronous rectifier
or "ring demodulator"

Designed for military and industrial use: Bristol Synrocverter Switch is designed for a wide range of applications, including precision use in aircraft and guided missiles at high altitudes, gas detectors, electronic computers, instruments, null detectors, and many similar devices.

Contacts: Contacts are provided for double-pole reversing switch action, or two synchronized independent single-pole double-throw actions.

Response: The switching time is in the order of 50 micro-seconds.

Effect of Thermal and electrical: Extremely small thermal and/or electrical effects are self-canceling by the double-pole reversing contact arrangement.

Switching Dissymmetry: Less than 1/2 of 1 percent.

Normally closed: in a military-type case against dust and corrosion.

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previously mentioned would have to be performed between each firing operation. Obviously, if these necessary firing steps and intermediate operations were learned, production would be simplified.

► **Thinner Walls—**Another promising possibility with the bigger piston is thinner wall sections. One difficulty that has been encountered is that die castings up to this time are reported to have been unable to withstand the prolonged high pressures needed to close the metal to flow and fill the cavity without the die being permanently deformed.

Since piston firing action is the product of pressure multiplied by time, operation now set at theoretically possible to produce thinner sections, because with the greater pressure available, the pressure application time possibly could be greatly reduced.

Better die materials, improved lubricants and the greater rigidity of the new piston can in some degree help in the solution to the problem. Through this approach, closer tolerance firings probably will result.

► **Strikely Military—**The warplanes that will come into existence under the Air Force's heavy piston program must be considered special equipment. Right now they are viewed as essential tools to meet aircraft, engine and some airborne military needs in an emergency build-up for a period the end of which cannot now be foreseen.

But when this military emergency is over, how will the piston machines figure in the industrial situation? On this point it is generally agreed that the heavy piston units will be adapted, generally to a standby status. There probably will be limited operation for very advanced aircraft and engine designs, to produce components with strength/weight ratios that will be "meaty" for experimental military phases of the future.

What it shows the possibility that the piston can be put to commercial use, and operators already are making their brains to justify these applications. But at the moment, the commercial outlook for these pistons is not too promising, because of the expenses involved—the costs would be high and large runs would be required to justify piston operation.

Jet Blankets From Canada

H. J. Thompson Co. has formed a Canadian corporation to produce its Refractal high temperature insulating blankets for jet aircraft and other applications, also Thermo-Cush low temperature insulating blankets. Canadair subsidiary will be located at Geolphy, Ontario.

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WESTON

RUGGEDIZED INSTRUMENTS

C-124 Passing Combat Test in Korea

- Giant transport plays a key role in airlift.
- Whole wing now flies the Douglas plane.

By R. P. (Peggy) Martin
(Airline World News)

Tokyo—In a modest revolution in combat cargo air transport, the first C-124 Globemaster, a composite new version, is beginning to replace C-54s in the Korean airlift.

The Globemaster, now about two years on the Douglas production line, has been used in the United States by the Strategic Air Command's Strategic Support Unit squadron. It was given a thorough test in Alaska. But the first real test in squadron strength and under actual war conditions came in Korea, where a whole wing has been converted to the huge plane.

Preliminary evaluation discloses that the Globemaster is suitable for use as a normal combat aircraft. It is, however, too early to evaluate how the plane stands up in sustained operations under machine conditions.

• **Payoff Limited.**—Because of a shortage of planes in Korea, the Globemaster must carry enough fuel for the round-trip plus a safety margin. The payoff is now not going above 10,000 lb.

The Globemaster can get in and take off from short, rough fields—it can use a 3,000-ft strip—but there is no cargo utilization under these conditions. It is an exceptionally steady plane. One loaded chair had hit a four-foot bush, knocking out its left landing gear. But the plane rolled 5,000 feet before the gear finally collapsed. That was the only cargo compartment accident thus far.

The C-124 has by no means replaced the C-46, C-47, C-54 and C-119s that are the workhorses of the airlift. The smaller planes are the main airlift for short or shuttle runs. The C-124, now, however, is a key part of the team that has carried more than 1.7 million passengers, more than 240,000 air crates and approximately 100,000 tons of cargo to and from Korea.

• **C-124 vs. C-54.**—More data may be developing in terms of operational efficiency, but here is a comparison of the C-124 and the C-54. The C-124 carries four times as much cargo and four times as many passengers as the



MANPOWER can be moved but in the large Douglas C-124 transport. About 300 combat-loaded men and their baggage can be moved in a flight.



MAINTENANCE end repair of combat-damaged equipment is hastened. This plane is being loaded for flight to Tokyo to be rebuilt.



MEDICAL are casualties of sick and wounded to reach where proper treatment can be given is isolated with using many tons in the Korean war.



MATERIEL in large chunks has been moved by C-124s in the Korean airlift. Largest single item was the 85,000-lb plane mover used for landing airships.

C-54. It is the only cargo plane that can carry an M24 light tank.

It has a gross takeoff weight of 175,000 lb. and is driven by 5,500-hp (total) engines, compared to the 71,000 lb. and 1,450-hp engines of the C-54. Its cruising speed is 2,400 mph and 2,500 mph of fuel on time covered at 170 to 175 knots on the Korean run. The C-54 uses 1,200 lb of gasoline an hour. The C-124 is 127 ft 1 in. long, has a wingspan of 175 ft 4 in. and the tail stands 40 ft 4 in. high. The C-54 is 91 ft 11 in. long, spans 117 ft 6 in. and stands 37 ft 6 in. high.

• **Tramp Transport.**—The Globemaster's immense capacity (25 tons of cargo, or 200 combat troops, or any combination of the two) makes it ideal for cargo or troop transport on all but shuttle runs. Although it has not been used to its full capacity. In the past, the 115th Air Division (Combat Cargo) moved troops with four planes in Korea or four tons to base in Korea. Some of these units have been moved 20 times or more.

But the only unit left by the C-124 thus far has been a prisoner movement of 3,500 men. Four Globemasters were used in the lift, each averaging about 150 combat-loaded men, each man with a headcrushed helmet, bag, fifty vehicles, 10 tons and large quantities of supplies and gear. Each was loaded at the same time.

Twenty-five of the C-124s could move 5,000 equipped combat troops one way or the other in an effort. By shunting the planes back and forth, command centers of troops could be moved quickly anywhere in the Far East.

• **Evacuation of Wounded.**—While proud of the Globemaster's cargo capacity, Air Force pilots are also quick to point out how the plane has saved lives by one or two evacuations of wounded. It took only 20 minutes from the time the wheels touched ground until the first of nearly 100 wounded were aboard on boardings at a C-87 that crashed there to a nearby hospital. Later tests proved some patients down the road, while others were included in the elevator.

The history of the C-124 in Korea is an exciting story of freedom, of persistence and faith, of comparative success. Made in 1951, the C-124 is P. H. Hatcher, CG of the 115th Air Division, noted that there is no other plane in the Korean airlift. The first plane from the Air Force Command arrived in September. The crew had orders to test it under all conditions and with every type of cargo, passengers and air equipment. The test was successful. A world's record load of 167 air crates, 102 of them litter patients was set. Two 25-ton loads of hand grenades and 100 tons of supplies were lifted from Japan to Korea. There was no one else on either aircraft. And, the heaviest single

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SPECIAL DOCKS were built for C-124 antismoke, as longer paved too small.

area carried was a 33,000 lb. main rotor tank. Rotor was a 33,000 lb. Air Force for tank, the package of a wrecked F-86, H-19 helicopter fuselage and extraordinarily heavy items that could not be carried in a C-119 were carried.

Airfield Assignments: The Air Force assigned a reconnaissance to C-124s to be assigned to the airfield. This young a Mobile Training Unit from Clinton, IL, arrived in Japan. Selected flying crew personnel were trained to train the 374th Troop Carrier Wing. Grounds maintenance assigned from there to an area. In addition to several maintenance and checking, pilots took 40 hours in the Leadership School. They also flew C-54 missions to Korea to maintain their flying proficiency while training on the Globemasters.

The instructors were primarily in maintenance. Some of spare parts and other equipment, which had some items had not been given priority, were all loaded at Travis field to make room for higher priority cargo. The C-124s arrived in Japan, some of them being crew members left.

The Pacific pipeline and merchandise on both sides of the ocean are not yet fixed with critical parts, then emphasize the already difficult problem of maintenance. The C-124s are responsible for a greater proportion of the time than the C-54s, simply because of the shortage of parts and inexperience of the ground crew. On occasion, only one of the planes have been operational. Experienced officers suggest that a system be established to eliminate the backlog of parts that a unit will need to replace efficiently occurs.

The day for the long-range flying spirit had to be prohibited to accommodate the large planes. There are no hangars in the theater large enough to accommodate them, so most docks had to be built for maintenance, all of which is done outdoors. The antismoke could run simply, water on the four Pratt & Whitney R-4160 20W engines. Most parts and all cables are placed, labeled so there is little chance of confusion or

misuse. But ground personnel have not yet learned all the short cuts that speed up maintenance.

Fifth Air Force was somewhat worried at the thought of what the big planes might do to carriers on the tactical fields. Actually, if some are a lot out of the line, the Globemaster has a lighter engine power per square inch than a C-54. It is doubted that the planes are harder on carriers than heavily loaded B-29s and B-44s.

The first work of July, Brig. Gen. Chester E. McCarty, 315th Division commander, took to Korea the first load of supplies down by a C-124 all-Combat Cargo crew. He carried five 151 jet engines on the outgoing trip and brought 117 passengers back to Japan. Since then, the C-124s have made regular flights to and from Korea and have loaded cargo up two tons. Gen. Oles, the 315th and 1st Air Division. **Easy to fly:** A majority of the pilots now prefer the C-124s to the C-54s. This is not an easy place to fly. In the air, there is a tendency to sacrifice safety, possibly because the aircraft is not as acrobatic pilots have not yet become accustomed to it. Passengers feel no discomfort, but the pilots admit experiencing "a weird sensation" on the flight deck.

The pilots at 26 feet above the ground. In training, they quickly discovered that more sensitive depth perception was needed, especially on night landings. They also had more difficulty adjusting themselves to the wind for calculating ground roll in hot weather.

The more experienced pilots say the instrumentation never anything to be desired. The position of the flight group of instruments seems "on to most or needs not much," they say. But all of the pilots like the simplicity of the instrument panel. All engineering instruments are on the engine's panel, so the pilot is concerned with power and instrument flying instructions.

Despite its bulk, the C-124 has considerable maneuverability. Flippers on the top side of the aircraft go up 24

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and a maximum rate of fall of 10 feet.
This flying is more comfortable for an
airman. The Globemaster has emergency
compass with 270 ohms and 1110/
with 18 ohms, plus one guard channel.
For expense in the C-124's equipment
A, plus high-pressure compressor
trans receiver, can be substituted on
UH1 if ground control is lost.

The engineer's panel is about the
same in a B-16. A prospective C-124
panel engineer can run the engine in
these modes of the fuel had experience on
the B-29, B-50 or B-56. A non-panel
engineer goes to ground school for
about 100 hours instruction at the
panel, but a qualified panel engineer in
rank after about 40 hours.

Under the C-54, the Globemaster
has all-electric instrumentation. If a
C-54 loses the two inboard engines, the
pilot has no instruments. The electrical
system goes out on the C-124 but
the pilot loses his instruments.

Panel gauges read in pounds rather
than gallons to simplify calculation at
baseline and total weight, which are at
least important in the C-124. The
engine gauges read 66,000 lb. of fuel
in six tanks, but these coming out of
the fuselage save some an additional
1,000 lb. and have 12 fuel tanks. Panel
engineers seem to think the tanks
become the external fuel system
have only six controls. There are 24
switches on the new electric fuel system.

The navigator's job is simplified by
automatic calculation of true air speed.
But he must go to the lower deck to
read the data.

• **Life-Flight Safety.** The C-124's emphasis
is flight safety. If the aircraft,
fuel loading door or any forward door
opens a warning light flashes. The pilot
is warned if the autopilot goes off be-
cause of electrical failure. Lights in the
fuselage illuminate wings and engines for
in-flight emergency. Lights in the
loading gear provide illumination for
pre-flight inspection.

All sections of the plane are readily
accessible during flight. The prop re-
tractor, gear and the automatic
pilot amplifier are in a compartment be-
low the flight deck which also contains
the radio equipment that is not on the
flight deck. Automatic pilot gear is in
the tail and other compartments
which are accessible.

A compartment provides access to the
wing components generator and
power rails. In-flight repairs cannot be
made on the prop or landing edge of
the fuselage, but the maintenance, fuel

pumps, gas lines and electrical system
in each engine are accessible.

During the training session, an in-
flight emergency is simulated and all
pilots and crewmen go into the wing
separately to track down the trouble. In
a severe flight from Kansas with 134
passengers, the left outboard engine
caught fire. The automatic fire ex-
tinguishers did not function properly,
and a man, Sergeant Curtis Huggs,
crawled through the wing and put out
the blaze.

The plane has a 660,000 Btu heater
in a pod on each wing to prevent
icing. Two others are in the engine
44 ft tail, to prevent icing on the sta-
bilizer and to warm the passenger com-
partment. A 260,000 Btu heater keeps
the flight deck comfortable. In the
Alaska test, carburetor heat was suffi-
cient to prevent icing even at outside
temperatures of -40°.

• **Load Handling.** A fully loaded C-124
weighs empty at 9,000 lb. and more
than allowable weight is 210,000 lb.)
is an average example of the "push-
button air" as it moves up to the
loading ramp. The huge thrust
does under the flight deck wing down
and the double-rod wing ramp
112 feet long when folded drops slowly
and then locks out the wheel-mounted
forward section. Fully extended, the
ramp extends 127 feet. The ramp can
be adjusted to any yaw while the
plane will carry. At night, lamps inside
the nose floodlight the ramp and on-
board air.

Loading and unloading is almost on
track mechanism. A watch block is
used to play cargo in position where it
can be lifted on one of the two loads.
One cable of the hoist can carry 2,000 lb.
All four can carry 8,000 lb. lifting
straight up. With the aid of winch
blocks, they can lift 16,000 lb. The
heaviest cargo is winched in from out-
side the plane, while big trucks work
inside. The hoist operator from the
fuselage can see that cargo can be
checked straight up without placing ex-
cess stress on the hoist or the cables.

The machinery inside the plane can
support a maximum of 50 pounds per
square inch. The main deck area will
support 50 pounds, while the "tail"
or design area will support only 15 psi.
This design area must be forced out
to support heavier cargo.

The electrically-operated elevator will
lift 9,000 lb. and will support 9,000 lb.
in flight.

Safety is emphasized in handling
cargo. The hydraulic pump that can
be used to operate the nose door and
main floor door and wings are all
external but have controls—two in the
flight deck for the pilot and engineer,
and one at the nose door.

The lock is the diamond door is a
mechanical steel finger that reaches



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over and change on the other door before pulling back into a locked position. A pin lock on each of the doors will hold them in place if the door latch should break, in a contingency, the emergency door can be dropped. The elevator can be dropped in flight, or lifted out and the hatch used to get into cages.

The hatch also has automatic shut-off to keep three lines rolling during movement of cage. A good provision there from being driven off the rail through careless operation.

The G124 is a two- or three-deck according to need. The lowest deck, about 51 ft. deep, is for small cargo. The main deck will hold a single item measuring 12x12 ft. It can be divided into an upper and lower compartment by lowering a third panel from each side. Loadbars on both decks are 6 ft. 3 in. Two sets of web struts are stretched on hanging removable pins in the center of the plate. Ladders or stairs are also fitted on each side of the plate on both decks. Safety pins hang from each end of the upper compartment fully loaded, the G124 can carry 127 light trucks and eight attendants, or 290 coal trucks with personal equipment.

Time Saver: "There is some criticism that the G124 takes too long to load and unload, but much of the criticism seems unreasonable. The length of time spent on cargo, of course, depends on the type. Three 6 x 6 trucks fully loaded can be driven off or on in a matter of minutes. A full load of coal trucks can be out of the plant in four minutes. Sixty-five ambulances and 102 fire engines were unloaded in 33 minutes. The heaviest cargo can be loaded and unloaded from the G124 in about 34 hours.

Experiments are being made with rills, intended to reduce the between-flight time lag. Diagrams of cargo space are drawn on the ramp, and weight distribution is planned beforehand. But this uses no considerable ramp space, and there is a variety of size of Fast Air Force boxes. Sample cables and fasteners which can be attached or released in a few seconds are standard equipment.

A major consideration is the need for constant care in cargo handling while speeding up the time around base. Each G124 is valued at about \$1 million. All personnel has to be carefully and properly trained. Four hand ladders are used. Track-down and flexible operation means speed training. Plans took the Loadmaster course, including driving of traffic, so they could super-vice unloading at fields where trained personnel might not be available to do the job.

The G124 provides comfort and safety for both passengers and crewmen. The two pilot seats slide side-

ways as well as forward and back, providing room for passengers and a comfortable fit for any one pilot. The seats are also semi-Skopos, so that a pilot can relax on long trips. There are three passenger benches and a large bed set to provide rest much for the emergency crew.

All compartments, except the small cargo lockers, are accessible in flight. Two ladders connect the flight deck and other compartments. There is also a telescopic lifeline's pole as an emergency escape hatch from the flight deck to the wing.

Eight ladders are provided for male passengers, and another for the female. A portable toilet can be set up to provide for needs. Portable oxygen bottles are aboard, and there is a built-in oxygen system and outlets for all passengers. A loud speaker system provides instant tactical communications from the plane captain to crew men and passengers alike.

Crewmen are debriefed about passenger comfort in flight during tests. "The noise doesn't get loud, and those sitting on the forward part of the ship may feel it uncomfortable and depend on being made with a rubber cushion. But will not off the passenger compartment from the nose, but it is not yet been approved."

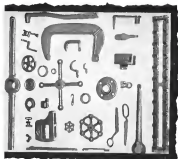
Good Use: "We're making effective use of the G124," Gen. McCarty told Aviation Week. "They are now in daily use, mainly on our high-density route between Seoul and the Tokyo area. Most of the flights are made in about 34 hours, plus and minus several days to the strength of loadbars."

Passengers meet them in UN aircraft personnel coming to begin on the day. "R & R" (rest and relaxation) leave, "except the trip. They feel as if they were being classified on the ground in a Cadillac or Lincoln. There is the usual nature of the plane, since it gives them a lot of space to sit in and look out the windows. The G124 is suggested compared to the G124. The men also like the flight experience, which they are generally treated to visit," McCarty added.

He said the G124 has proved "very adaptable" in handling unusual types of bulk and heavy cargo. Since risk and on equipment to Korea takes a month or more, creating a lot of time at the docks, the quick shift is extremely important.

"One recent mission," said Gen. McCarty, "was when an F-4 was damaged from the States. Two big jet refueling tankers were needed in two days. They were needed in a hurry and could never have arrived in time to us. We put them both on the same plane and had them there in 34 hours."

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(McGraw-Hill World News)

Melbourne—An automatic indicating system which enables tower operators at a glance to select the safest runway for aircraft to land and take off on has been developed in Australia.

It is being evaluated experimentally at Essendon Airport, Melbourne. The experiment has enabled the airport to handle higher density traffic.

Apparatus is simple, consisting of a chartlike, circular diagram over which moves a thin beam of light to indicate wind direction and wind strength. This is linked up to a relay indicator with a three-dimensional, fixed wind and rain wind components on the duty runway as indicated by scales and runway markings on the diagram. The line of light varies in length, depending on wind strength.

The chart, or Runway Selection Console, is driven up on polar coordinates, with straight lines emanating from a center point indicating true bearing, as on a compass card.

Radial coordinates (lines of increasing diameter) emanating from the center point and intersecting the angular coordinates give the speed of the wind. Each radial is graduated to indicate wind speed and the further the line of light reaches out from the center, the higher the speed.

Colored arcs on the chart represent runways and define the wind indications under which takeoff or landings are to be conducted. Red colored arcs signify operations are not permitted at the airport.

The equipment was conceived by I. S. Trenchard, senior aeronautical engineer in Australia's Dept. of Civil



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A four-quadrant, 20-in. swing drilling machine has recently been redesigned and is recommended for a variety of production drilling jobs by manufacturers. Designated as Model MC20, the new machine's capability of 1/2-in. drilling in mild steel is matched by a stronger column and a heavier base to provide the necessary stability and resistance. Security for small size drills makes possible a variety of drilling jobs.

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FINANCIAL

Avionics Maker Hits Profit Peak

Sharply rising sales and earnings are reflected in annual reports recently being released by various segments of the avionics industry.

Collins Radio Co., a leading supplier of aircraft equipment, depicts new peaks in sales and profits for the fiscal year ended July 31, 1952. Total sales for the current period reached \$64.3 million, up some 218% over the \$19.5 million reported for the fiscal year ended July 31, 1951. Net earnings more than doubled from \$37,682 to \$1,665,651 during the same period. After giving effect to the 25% stock dividend paid at the end of the 1952 fiscal year, earnings were equivalent to \$4.24 per share on 387,545 shares of common stock outstanding, contrasted to only \$1.76 per share for the 1951 fiscal year.

Redetermination helps—Price reduction on military contracts for most manufacturers has meant a reduction in earnings. Not so for Collins. Included among current assets is an item of \$2,469,786 representing "unfilled price revision agreements." Analysis indicates that this release enhanced net income under contract price revision as authorized for the 1952 fiscal year. This upward contract price revision clause then covers the company's reported earnings for the year. Significantly, net profit margins in sales for the 1952 period average only 2.6% as compared with 3.8% for 1951.

The net worth position of the company rose at the end of \$7,326,833 at the 1952 fiscal year-end. The net equity per common share was equivalent to \$17.58 at that point compared to an adjusted \$13.68 a year earlier.

Continued production for Collins is indicated with a reported backlog of \$150 million at July 31, 1952, contrasted with \$175 million a year earlier. To lessen its requirements the company increased its V loan to \$15 million and the maturity of this revolving bank credit was extended to Oct. 31, 1954. Total long term borrowings aggregated \$2,210,000 at July 31, 1952.

Loss of Customers—A major source of Collins' revenues can be drawn from the sales of its backlog. Production programs of "about equal size" are reported for the Air Force, Army, Naval Corps and the Navy-Air contracts. The latter built for the Atomic Energy Commission, Navy Development Bureau of Stranded, Treasury Department, and Coast Guard.

While government contracts recently comprise the major portion of the

company's production activities, indications of expanding commercial volume are clearly evident. The management reports that sales of airborne communication and aeronautical aids have more than doubled, and the "outlook for commercial growth in this field is excellent."

An example of additional diversification by Collins is found in its entry into the relatively new field of non-magnetic radio communication. Users of non-magnetic equipment include the oil and gas pipeline companies, electric power utilities, mining and lumbering activities.

► **Profitable Research**—There is no doubt that the successful current accomplishments of Collins stem from the quality of its engineering and its research work. Significantly, the company reports "many product new being manufactured" began in a development stage in its laboratories.

There are indications of even newer products to come. For example, the

company notes considerable work is in process on stabilization and guidance systems for automatic flight control of aircraft and automatic distance measuring air navigation equipment, as well as in engine components ranging from instruments to turbofans. Some of these projects are under sponsorship of the armed services while others are being conducted independently by the company.

The development of the Mechanical Filter, a device which makes possible full utilization of available frequency channels (Aviation Week, Nov. 3, p. 61), has recently been completed. This component is currently being incorporated in both military and commercial equipment as well as being sold to other manufacturers.

The second of two filter cyclotrons, popularly referred to as "atom clocks," designed and installed under contract with the Atomic Energy Commission, was completed during the year and placed in operation. Argonne Laboratories. The first Collins cyclotron is at the Brookhaven lab.

Development work in these various new fields depicts a very aggressive continuing program to solve problems of a leading position in the avionics field.

—Selig Altschul

Northrop's Gross Up, Net Down

Encouraging results in sales and earnings were revealed by Northrop Aircraft, Inc., in its annual report for the fiscal year ended July 31, 1952. Sales amounted to \$187.1 million, up 39% over the \$134.9 million shown for the 1951 fiscal year. Operating profit, before taxes, doubled to \$7.5 million for 1952 from the \$3.8 million reported for 1951.

Net income, after taxes, however, was down to \$2,420,000, equivalent to \$4.22 per share in the 574,899 shares outstanding. This compared to \$3,238,075, or \$5.76 per share, for the 1951 fiscal period. In view of Northrop's cumulative losses of prior years, sufficient to erode its equity, the company reported a 1952 taxable income. The elevated tax liability for all years' profits taxes and part of net income for 1951. Earnings in fiscal 1952, however, were fully subject to excess profits and windfall taxes.

► **Profit Pattern**—Northrop's net profit margins of 1.3% on sales for fiscal 1952 may well be indicative of a pattern to be revealed in subsequent annual reports by other aircraft builders. Valuable differences between patterns to be a major selective factor, by virtue, if not increase, the prevailing earnings level.

Northrop's backlog at July 31, 1952, aggregated \$416 million, with "ad-

ditional additional orders" reported since that time.

To meet its expanding requirements, the company increased its borrowings to \$7 million at July 31, 1952, under its \$8 million revolving bank credit agreement. A remainder of part financial difficulties is indirectly reflected in the Reconstruction Finance Corp. indebtedness reported to \$7,500,000 at July 31, 1952. Repayment to RFC during the year totaled \$860,752, but an additional \$1.3 million was borrowed from the same source to finance the construction of new facilities.

► **Diversification**—While the backbone of the company's backlog is represented by production contracts of the F-86 series diversification activities extend to the company's operations. The acquisition last year of the Radiologic Co., a manufacturer of radio-controlled target planes with a backlog of \$16 million, was a step in this direction.

Northrop also reveals its recent entry into the manufacture of precision instruments. The company has long been a factor in guided missile development and the management anticipates that this program will continue to grow.

A continuous search program also appears prominent in Northrop's plans as a means of sustaining future production activity. This is becoming a characteristic of aircraft builders.

—SA



RIGHT INSTALLATION of Hamilton Standard safety device.



RIGHT INSTALLATION of propeller reversal governor.

Aviation Safety

New Safeguard Against Prop Reversal

- Hamilton Standard hydraulic device is designed to prevent short circuits, errors in cockpit.
- Mechanism requires two signals from pilot before valve closes to build up pressure for reversal.

By Alexander McFarley

Windsor Locks, Conn.—A new safeguard against the hazard of inadvertent propeller reversal will be ready for initial service test at the end of November, Eyle Martin, general manager of Hamilton Standard division, United Aircraft Corp., told Aviation Week.

The new device is designed to safeguard hydraulically against disconnection of electrical relays or a faulty throttle lock mechanism, both of which have been blamed for several recent cases of inadvertent prop reversing. Still in dispute is the most serious of the recent accidents, the National Airlines DC-6 crash at Elizabeth, N. J., Feb. 11, in which 26 plane occupants and four persons in an apartment building were killed.

CAB has issued a finding that the probable cause was "reversal in flight of No. 3 propeller with relatively high power, and subsequent feathering of No. 4 propeller."

The new mechanism is a valve ac-

ting stream that uses function as the safety valve on a piston engine. It is a low-pressure relief valve in the hydraulic line which actuates the mechanism turning the propeller's blades into reverse pitch.

How It Works—To prevent the propeller blades from reversing pitch the system requires additional higher level double pressure than for normal pitch control operation. To get such pressure, two solenoid valves must remain closed in the hydraulic line. The new safeguard provides that the propeller governor has to get two separate signals, one at the new valve and one at the other low pressure valve already in the system, to function. Unless both signals—an armature signal and an actuating signal—come through, the valve doesn't close and there isn't enough pressure to make the propeller reverse.

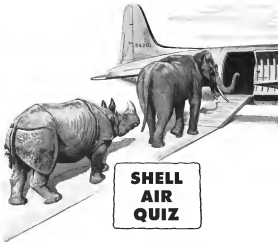
AEPA Propeller-Hamilton Standard's chief engineer, Carl Bates, and chief product engineer, Roy Lambach, say that the new valve safeguarding going into service test is a step ahead of the original Air Line Pilot Association proposal

for a safety valve, which led to the engineering development. Under the original suggestion, when the propeller received a reversing signal it would go to low pitch before it stopped the pitch change. This would mean that there could be a period of overcontrol condition at low pitch with possible damage to the engine until the pilot could correct it.

The new arrangement does not change the constant speed control until the complete double signal is given. It allows a period for overcontrol in low pitch.

Feathering Overide—The hydraulic safety valve is one of two new features which Hamilton Standard is incorporating into its newest constant speed controls. The other feature is an overriding control which makes it possible for the pilot to feather the propeller directly from reverse pitch. Previously it has been necessary to disengage the reversing control before the pilot could feather the prop if it was already in reverse.

Making these two changes and incorporating them within the narrow confines of the propeller governor means a replacement of about 95% of the parts of the current DC-6 governor. The major changes involved in the governor are still far less complicated and more foolproof than in alternate proposal to use a mechanical means of



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integrating propeller control, the Hamilton Standard engineers say.

Such a mechanical control (isolating methods or similar actuation) would require rigging the controls not to touch of the controls through the wings with attendant problems of jamming or malfunctioning actuation due to wing deflection, etc. Added to that would be additional weight and the problem of providing an arrangement to support the mechanical control at the governor, Bole and Lashbrook point out.

► **DC-7 Governor**—The first of the governors with the new features already has been ground tested on two engines, the Wright R3359 compound engine which will go on the DC-7 and the Pratt & Whitney R3500 used on the DC-6.

However, it is only a prototype installation and some changes are being made in the server test quantity of DC-6 properly governor case being manufactured.

Demonstrations recently were held by Hamilton Standard at its test cells at East Hartford for CAA, CAB and airline executives in which the DC-7 governor showed how it could perform as two new functions. The governor also has been run as the Wright engine at the Wright Aircraft Corp. plant which is located at Wood Ridge, N. J.

The DC-7 governor was in design stage at the time the ALPA proposal came through last spring for a relief valve arrangement. It was selected as the fastest way of getting the new features into test.

The main difference between the DC-7 and DC-6 governor is the fact that the DC-7 governor is a larger pump to activate the larger propeller. Hamilton Standard is satisfied that the demonstration with the DC-7 governor is sufficient test to warrant going ahead with the revised quantity of DC-6 governors.

Since the idea came from American Airlines pilots, Hamilton Standard expects that the first tests will be made on American as a DC-6. However, all the airlines operating the equipment have been notified that the new type governors are being made available in service test quantity.

The Hamilton Standard points out that the original plan proposal was made to them, nearly a month after the National Airlines crash and not before, as has been implied in a Time Magazine article.

The Hamilton Standard engineers point out that the new safety device is subject to the limitations of all hydraulic devices but is no help insofar as they can make it.

Other features used in the new safety valve system are components which already have had long reliable

service experience and have been proved for varying temperature and vibration conditions.

None of the cases of inadvertent reversal reported they point out, has shown any evidence of malfunctioning in the hydraulic system. The new installation is not relying on power by electric dependency as a protection against malfunctioning in the airplane control system.

While many other means for preventing inadvertent reversals are still under consideration, Hamilton Standard does not plan to make the new relief valve a mandatory addition on the new governor, but looks a provision for its inclusion at the airline's option. The other new device to allow feathering from reverse pitch will be made a stand out feature of the new governor.

Airline pilots have expressed some concern because both new features are not listed as standard in the new provisions.

New German Airline Seeks U. S. Planes

(McGraw-Hill World News)

Frankfurt—Dr. H. C. Seeböhm, German Federal Minister of Transport, says that a German airline will be in business by Apr. 1, 1953 provided contract agreements with the Allies are signed according to schedule.

The West Germans have turned down British offers to supply Cessna and Viceroy and decided to buy U. S. planes, say well-informed sources. Preference have been expressed for the Cessna 140. The U. S. Export-Import Bank already has been approached for necessary funds for buying the necessary equipment.

► **Private Capital**—Dr. Seeböhm has said that the new airline is getting planes of "the most modern design" early next April.

Industry and banking representatives have conferred recently with Dr. Seeböhm on the possibilities of raising private capital for financing the new West German airline. A firm is to be named the Aviation Enterprise Corp., or to be formed soon to act as an interim agency for the carrier until such financial agreements have been formalized.

According to reports from Bonn, the German government will hold 51% of the shares of the carrier, and private capital the remainder.

In addition to consulting principal European cities, the new carrier expects to have services to Rio de Janeiro, Buenos Aires, New York, Calcutta, Bangkok and Tientsin. Plans include flights at a later date to South Africa and Japan.

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USCG Sets Up Civil Air Unit in Hawaii

An *Albatross* air unit in the Hawaiian Islands has been organized by Commander Robert Leary, USCG.

The unit is made up of many small boats and planes operated all over the Territory. Purpose is to get to a crash as the fastest possible time. Because of the geographical layout of the islands, the Coast Guard's planes or boats might take a while to reach a wreck in some remote corner of the Territory.

When they go out on an emergency, members of the unit have all the privileges and authority of the Coast Guard. And the service takes care of all fuel and all expenses incurred in any action and stands behind any liability claims which might arise.

New Route to Brazil

(Middle East World News)

Rio de Janeiro-Pennair is establishing an air service between Vancouver, Canada, and Brazil, which will provide a direct link between South America and the Far East, has been granted by the Canadian Pacific Airlines. The new route, reported to be in operation before the end of 1955, will run from Vancouver to Rio via Mexico City, Lima and Sao Paulo connecting up with CP's flight routes to Asia via Vancouver.



NEW AUSTRALIAN TERMINAL PLANNED

Bruce's photo-drawn drawing brings 1 of the proposed revision of master at Kingsford-Smith (Melbourne) Airport, Sydney, Australia. The first stage of the big operation, will see an \$8,000,000, money and land strip ready for traffic in March 1955. The field is

being planned to take big transport planes. A major task is diverting Cook's River, which now winds through the site, to the cause indicated by dotted lines in left. Work on the new terminal began December 1954.

SHORTLINES

► **Annapolis Railroad Co.** has asked a CAB certificate for faster service, Baltimore, Washington, Washington, Philadelphia, and New York. All-American Airways, local service airline serving these cities directly, may claim first rights to such a service.

► **Boeing** Airways domestic mail rate has been set by CAB at a "temporary" 55 cents a ton-mile retroactive to Dec. 1 of last year, pending formal decision in the permanent rate proposed by CAB but opposed by the Post Office Dept. Us has CAB will have Boeing to create an "emergency regulations" move. Company started Boeing 748 service Nov. 1—has so far received 7 of the 30 orders.

► **California Coastal Airlines** plans to install a new radio receiver before it covers with "superior performance" and "half the cost" of present types. It's made by Fluor-Tronics, Inc., of Burbank.

► **Civil Aeronautics Board** is studying seriously possibility of the State-owned, but National and Pan American. Over 100 passengers are contemplated. CAB has warned all airlines it will investigate anticompetitive behavior of companies applying for service. National charges in Eastern

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control of Calumet over the most sensitive operations—expected to delay the Calumet freight route. Similarly, American charges against North American with being a candidate in violation of law and CAB regulations and hence out to be granted a route change from Toronto to Seattle, British Columbia.

► **Colonial Airlines'** domestic mail rate is set by CAB at base rate of 43¢ cents a mile based on fuel factor of 45¢, with dollar rate change for changing month's fuel factor, based on a 12-cent DC-7 and 10-cent DC-4 effective date in Apr. 1 of this year.

► **Commerce Department Secretary Charles Sawyer** asked CIAA to liquidate now to speed up airport construction through revision of the federal aid program. Since 1946, Congress has appropriated a total of \$195 million. CAA says a September survey showed need for another \$190 million, which local communities would match with another \$190 million.

► **Eastern Air Lines** has started its first daylight coach operation. New York-Miami nonstop, three flights daily. National Airlines started daylight coach over a year ago and now also operates three a day—two morning and one via Jacksonville and Tampa. Both EAL &

NAL operate DC-4s on daylight coach service.

► **International Air Transport Association** second order increases this July and August. Inlandfares elsewhere were about \$10 million each month-up over 40% from a year ago. Total the first eight months this year at \$145 million vs. \$55% over a year ago.

► **International Civil Aviation Organization** plans to meet at Pan Am and Pacific office from Melbourne to Hong Kong, close to the center of that area's operations.

► **Mohawk Airlines'** Francis Robinson, new route to Boston, announced through dissolution of Western Airways, will spend company independence from Albany, CAB says. The new Mohawk route also includes Portland, Springfield, Westfield and Worcester, Mass.

► **National Airlines** would be a vital link between Canada, U.S. and South America if the President allows CAB approval of the Balboa route case for Latin American interchange service and if CAB continues to favor National over Eastern in the Calumet matter.

► **National Production Authority** aircraft division has been consolidated into the NPA Aircraft, Ordnance and Shipbuilding division.

► **Northwest Airlines'** October load factor of about 66% compares with 70% in September and 71% and 74% respectively a year ago. Reports average domestic city is now 70% in, compared with 64% in last year, 46 in 1956, 57% in 1949, and under 40% under 25 years ago. Average international NWA's trip is now 1,745 miles.

► **Pan American World Airways** is replacing its Stratojets in South America with DC-6s. The Boeing will go to Pan Am's long-range, low-altitude Pacific routes.

► **Transair** reports its newly modified DC-6s with Pratt & Whitney CB-16 engines almost came speed 35 mph., making its Miami-Batavia-Alam route "the fastest ever flown by any airline."

► **United Airlines'** Alaska States plans Nov. 19 departure of its first trans-Arctic DC-6B de Havilland flight from Seattle to Copenhagen via Edmonton and Thule. This flight will be the first of two exploration flights during the trail by a regular commercial schedule which SAS hopes to inaugurate soon. The shortest route "via-havane" U.S. West Coast travel to Europe for complete classes.

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The Complexity Problem III

By Wing Commander A. U. Hoyle, DFC
(The Second of Two Installments)

► **Strong and Brakes**—Two good examples of vital design provided by nonmetallic strong and control linkages. Nonmetallic strong link only used for the few galleys of fuel normally required for taxing in order to offset all the additional weight of the strong component. The ease and speed of getting into position soon to make it well worth while, and likewise, in the case of brake linkage, the pilot can still maneuver to avoid hitting obstacles. Nonmetallic linkages add little to the weight, but they cut down on weight on the landing gear and reduce wear of tires. Aerodynamic length and type of surface are restricting the ability of jet aircraft to operate clearly behind an advancing arm. Nonmetal linkages will add to the fighter's adaptability.

► **A Place for the Pilot**—The subject of Arm support leads us to the consideration of another aspect of aircraft design, namely, the use of strong and more economical

metal linkages were necessary to allow pilots to reach the altitudes necessary to shoot down the enemy's reconnaissance aircraft. Have we gone so blindly from there? The weight penalty for structure and blower is high and the vulnerable area is excessive. It is also difficult, because of the problems in numerous different parts at high altitudes. An expenditure of a few million dollars at the end of the road should be sufficient to develop a suit for the pilot which would be a combined nonmetallic pressure suit and air G suit. The pilot would still be protected for high altitude bailout and have protection from the cold for his fall.

Without pressure suits, a bullet hole in the fabric of a canopy and loss of the pressurized oxygen for the pilot of a high-speed aircraft to 44,000 ft., because the cockpit pressure falls far below ambient pressure for the altitude at which the aircraft is flying.

► **Other Considerations**—In concluding my comments, let me estimate my own feelings in attempting to solve some problems, as are too often becoming confused over potential things that will probably be in the event of war.

It would be good to say that we have aircraft with the greatest rate of roll—some 370 deg. per second, with an actual equivalent 540 deg. per second. The requirement for a high rate of roll is a requirement of an aerodynamic, aerodynamic, and it plays little part in any type of aerial fighting. Aircraft now in production actually have too high rate of roll for even the best of pilots to maintain sufficient maneuverability.

And here we, by getting a crash helmet on the pilot, really solved the problem of preventing him from cooling his head?—Or have we at the same time provided him with blinkers such as you formerly used to prevent horses from looking backwards? In the next war it will be part is necessary for a pilot to see beyond his tail as it was in the last.

Again, during the last war the engineers decided to put weights in the Spitfire control system because some good tried to show how strong he was, instead back on the stick, and the stick was light. The extra weight impeded the pilot and seriously slowed down maneuver in the turning phase, and although there was no order against it, the weights were tossed away. How long can a country go on winning wars in spite of all this sort of thinking?

► **The Ideal Fighter**—The ideal fighter would have inherent altitude, speed, rate of climb, range, maneuverability, strength, safety, and maximum thrust and landing run, fuel consumption, size, weight, and cost. Unfortunately, the requirements conflict with each other, and it is much easier to criticize than to arrive at the ultimate compromise.

We can't, however, get even close to it if we build aircraft for the fact that compromise have to be made. Personnel who are in the service today may not fight the next war, but it is their duty to pass on the best possible tools and knowledge to the man who will fight it for them.

Every department concerned with the design of an aircraft wants perfection for his particular job. Therefore someone must be appointed to impose. Without such an expert we shall have complicated and weighty fighters. The more yokes, fuselage can become dangerous. Every significant component of a fighter must be examined separately, and repeated analysis drastically essential. It should be clear to reduce the weight of a fighter, while maintaining the same level and maneuverability, from 14,000 lb. to 11,000 lb. The rate of climb will be increased approximately 55% to 2,000 ft. speed and 45% to 4,000 ft. Furthermore, while the wing loading will remain the same, every other aspect of performance will be improved.

Such a task is worth striving for.

Wing Commander Hoyle is Chief Project Engineer at the Central Experimental & Provisional Establishment of the Royal Canadian Air Force, Ottawa. His personal views, presented in these two installments, are based on experience since 1940 in the RAF and RCAF as command pilot, squadron leader, and project engineer.



repositioning engine aircraft for strong and fighter bombing. Have we allowed our enthusiasm for our new toy, the jet, to blind us to the advantages of aircraft such as the Spitfire or Mustang for this type of work?

It is told, in war against a well-equipped enemy, to try to strike at a height of some 50 ft., and it is quite impossible to do a good job of spotting a target, changing course on it, and hitting it, at speeds over 100 knots.

The speed of the jet makes it unsuitable for striking, and its initial cost and low maneuverability make it most expensive. Though operators of this kind are unquestionably more dangerous (as far as ground fire is concerned) when compared to all other jets, let us not forget the number of aerial passes or sorties which have to be made at higher speeds in order to knock out an equal number of well-designed fighters.

► **Structural Strength**—At the risk of being called a heretic, I would suggest that our structural strength requirements be examined and possibly relaxed. We are now designing fighters with a load factor of more than seven and an ultimate of 10G. The advent of the jet-G test has led to a tendency to push the figures up again, because a pilot can now stand more. But the added weight penalty has made it difficult for the present day fighter to get above 40,000 ft.—and it takes a lot longer. At such altitudes it is impossible to pull more than 3G without falling out of the sky. This being so, why on earth do we set design to a normal load factor of 4 or 5 and an ultimate of 6 or 7.4G?

► **Pressurized Cockpits**—During the second World War, air-

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